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Volume 39

FERNS AND FERN ALLIES OF GUATEMALA

PART I

OPHIOGLOSSACEAE THROUGH CYATHEACEAE

ROBERT G. STOLZE

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FERNS AND FERN ALLIES
OF GUATEMALA

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OPHIOGLOSSACEAE THROUGH CYATHEACEAE

ROBERT G. STOLZE

Custodiana, Pteridophyte Herbarium

Field Museum of Natural History

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The National Science Foundation, Office of Science Information Service, granted the principal investigator funds which permit the publication of the final parts of the "Flora of Guatemala." The Museum and the principal investigator are most appreciative of this financial aid.

LIST OF ILLUSTRATIONS

1. <i>Botrychium</i> : <i>B. dissectum</i> ssp. <i>decompositum</i> ; <i>B. underwoodianum</i> ; <i>B. virginianum</i> var. <i>mexicanum</i>	7
2. <i>Ophioglossum</i> : <i>O. palmatum</i> ; <i>O. ellipticum</i> ; <i>O. reticulatum</i> ; <i>O.</i> <i>crotalophoroides</i> ; <i>O. nudicaule</i> var. <i>tenerum</i> ; <i>O. nudicaule</i> var. <i>vulcanicum</i> .	11
3. <i>Danaea</i> : <i>D. cuspidata</i> ; <i>D. elliptica</i> ; <i>D. nodosa</i>	15
4. <i>Marattia</i> : <i>M. excavata</i> ; <i>M. interposita</i>	18
5. <i>Osmunda</i> : <i>O. regalis</i> var. <i>spectabilis</i> ; <i>O. cinnamomea</i>	23
6. <i>Actinostachys germanii</i>	26
7. <i>Anemia</i> : <i>A. cicutaria</i> ; <i>A. speciosa</i> ; <i>A. pastinacaria</i> ; <i>A. hirsuta</i> ; <i>A. hirta</i> ; <i>A. oblongifolia</i>	29
8. <i>Lygodium</i> : <i>L. volubile</i> ; <i>L. heterodoxum</i> ; <i>L. venustum</i>	37
9. <i>Schizaea elegans</i>	40
10. <i>Dicranopteris</i> : <i>D. flexuosa</i> ; <i>D. pectinata</i>	43
11. <i>Gleichenia</i> : <i>G. palmata</i> ; <i>G. bancroftii</i> ; <i>G. bifida</i> ; <i>G. underwoodiana</i>	47
12. <i>Hymenophyllum</i> : <i>H. fucoides</i> ; <i>H. polyanthos</i> ; <i>H. crispum</i> ; <i>H. lanatum</i>	57
13. <i>Trichomanes</i> : <i>T. collariatum</i> ; <i>T. radicans</i> ; <i>T. reptans</i> ; <i>T. godmanii</i>	75
14. <i>Plagiogyria</i> : <i>P. semicordata</i> ; <i>P. pectinata</i>	92
15. <i>Cibotium regale</i> :	95
16. <i>Culcita conifolia</i>	98
17. <i>Dicksonia gigantea</i>	101
18. <i>Alsophila salvinii</i>	104
19. <i>Cnemidaria decurrens</i>	107
20. <i>Cyathea</i> : <i>C. tuerckheimii</i> ; <i>C. multiflora</i> ; <i>C. tuerckheimii</i> ; <i>C. fulva</i>	110
21. <i>Lophosoria quadripinnata</i>	114
22. <i>Metaxya rostrata</i>	115
23. <i>Nephelea</i> : <i>N. mexicana</i> ; <i>N. tryoniana</i>	117
24. <i>Sphaeropteris</i> : <i>S. horrida</i> ; <i>S. myosuroides</i>	121
25. <i>Trichipteris</i> : <i>T. schiedeana</i> ; <i>T. scabriuscula</i> ; <i>T. pansamalana</i>	125

CONTENTS

Ophioglossaceae	4
<i>Botrychium</i>	5
<i>Ophioglossum</i>	9
Marattiaceae	13
<i>Danaea</i>	14
<i>Marattia</i>	16
Osmundaceae	21
<i>Osmunda</i>	21
Schizaeaceae	24
<i>Actinostachys</i>	25
<i>Anemia</i>	27
<i>Lygodium</i>	36
<i>Schizaea</i>	41
Gleicheniaceae	41
<i>Dicranopteris</i>	42
<i>Gleichenia</i>	45
Hymenophyllaceae	51
<i>Hymenophyllum</i>	52
<i>Trichomanes</i>	71
Plagiogyraceae	90
<i>Plagiogyria</i>	91
Dicksoniaceae	93
<i>Cibotium</i>	94
<i>Culcita</i>	97
<i>Dicksonia</i>	99
Cyatheaceae	102
<i>Alsophila</i>	103
<i>Cnemidaria</i>	105
<i>Cyathea</i>	108
<i>Lophosoria</i>	113
<i>Metaxya</i>	115
<i>Nephelea</i>	116
<i>Sphaeropteris</i>	120
<i>Trichipteris</i>	123

Ferns and Fern Allies of Guatemala

The fern flora of Guatemala is exceedingly rich and diverse, and since such a great number of species is involved, it was thought more practicable to publish them in several parts of one volume. Part I treats all of the more primitive families, through the Cyatheaceae, and includes a total of 110 species. Subsequent parts will deal with the Polypodiaceae (*sens. lat.*), the water ferns Marsileaceae and Salviniaceae, and, finally, the "fern allies."

A number of phyletic systems have been suggested in the past 40 years by various authors, but among current pteridologists there appears to be more disagreement than agreement as to which scheme is the most "valid." Furthermore, in arranging genera and families in linear sequence, as is necessary in a floristic treatment, phyletic relationships are often confused or obscured. Therefore, there is no attempt here to deal with new problems of phylogeny or classification. A very conservative system is employed, similar to that of Christensen (in Verdoorn, *Manual of Pteridology*, 1938), and families are arranged in such an order. Within families, genera and species are arranged alphabetically. This is in keeping with the format heretofore utilized in all treatments in the "Flora of Guatemala."

During the early days of publication of the "Flora," the late Conrad V. Morton of the U. S. National Museum agreed to do the research on the pteridophytes, and for a number of years he expended considerable time and effort on the project. Unfortunately, the pressures of other research and, eventually, ill health prevented him from completing the work. Shortly before Mr. Morton's death in 1972, I was asked by Louis O. Williams to handle the task, and when I agreed, Morton very graciously offered to lend me all the notes on his research up to that time. These included species lists, a number of preliminary keys, and some notes on various genera, all of which have been extremely useful to me and have expedited the work considerably. It is with a deep sense of appreciation that I acknowledge his generosity.

I am indebted to Rolla Tryon and David Lellinger for reading portions of the manuscript, and for their valuable comments and criticisms on the treatment of many genera. I also wish to thank W. H. Wagner, David Barrington, Gerald Gastony, and Paul Windisch for advice pertaining to the genera with which they are especially acquainted. The fine illustrations were produced by Richard Roesener and Marion Pahl, who contributed not only their expertise, but their patience and understanding as well. I would also like to express my appreciation to Dorothy Nash and Laura Schlivek, for their assistance in typing, proofreading, and the countless other tasks essential to bringing the manuscript into its final form.

Research on Part I of the "Ferns and Fern Allies of Guatemala" has been based principally on the outstanding fern collection at Field Museum of Natural History. In addition, several thousands of specimens have been studied from the following herbaria: United States National Herbarium, Washington, D.C.; Gray Herbarium, Cambridge, Massachusetts; Museo de Historia Natural, Guatemala City, Guatemala; New York Botanical Garden, Bronx, New York; and the University of Michigan Herbarium, Ann Arbor, Michigan. I wish to express my deep appreciation to the curators of these collections for granting me loans of their material, or for allowing me to examine the specimens at their institutions.

Finally, I wish to thank Louis O. Williams, who has filled the multiple role of mentor, colleague, and friend throughout the course of this work. His guidance and encouragement have made it all possible.

All abbreviations of periodical publications follow the system of *Botanico-Periodicum-Huntianum*, Hunt Botanical Library, Pittsburgh, Pennsylvania, 1968.

KEY TO FAMILIES OF GUATEMALAN FERNS AND FERN ALLIES

- a. Plants homosporous.
 - b. Leaves ample, broad to grasslike (if very small, then with marginal or superficial sori), circinate in veneration (except *Ophioglossaceae*); sporangia borne variously on the margins or abaxial surfaces of leaves or on terminal spikes or panicles.
 - c. Sporangia thick-walled; annulus lacking.
 - d. Sporangia single, borne in panicles or immersed in the tissue of spikes; leaves not circinate in veneration (erect, or only folded over) **OPHIOGLOSSACEAE.**
 - d. Sporangia fused into synangia, borne on the abaxial surface of leaves; leaves circinate in veneration **MARATTIACEAE.**

- c. Sporangia thin-walled (1 cell thick); annulus partially to fully encircling the sporangia (or in Osmundaceae rudimentary or lacking).
- e. Annulus of sporangia oblique or transverse, uninterrupted by the stalk (or in Osmundaceae distal and often rudimentary or lacking).
- f. Leaves translucent, mostly one cell thick . . . **HYMENOPHYLLACEAE.**
- f. Leaves opaque, more than one cell thick.
 - g. Leaves dimorphous; sporangia not arranged in definite groups, borne singly or covering the surface of a segment; and commonly (in ours) borne on scarcely- or non-foliaceous fertile pinnae, or in rows on specialized, non-foliaceous marginal segments.
 - h. Annulus of sporangia few-celled at the distal end, or essentially lacking. **OSMUNDACEAE.**
 - h. Annulus of sporangia complete, oblique or transverse and apical.
 - i. Sporangia borne in panicles, or in rows on specialized, scarcely- or non-foliaceous segments; leaves various, linear to flabelliform, or pinnately or dichotomously branched **SCHIZAEACEAE.**
 - i. Sporangia completely covering the abaxial surface of fertile pinnae; leaves pinnate to pinnatifid **PLAGIOGYRIACEAE.**
 - g. Leaves monomorphous; sporangia arranged in definite groups (sori) on the margins or abaxial surface of leaves.
 - j. Leaves pseudodichotomously branched, scandent or trailing; spores 120-800 in each sporangium **GLEICHENIACEAE.**
 - j. Leaves pinnately divided, erect and arborescent or subarborescent; spores 16-64 in each sporangium.
 - k. Sori marginal, the indusia bivalvate; indument consisting only of trichomes, scales lacking **DICKSONIACEAE.**
 - k. Sori borne on the abaxial surface of leaf segments, the indusia scalelike to cup-shaped or globose, or lacking; indument of scales or trichomes, or both **CYATHEACEAE.**
- e. Annulus of sporangia vertical, interrupted by the stalk. **POLYPODIACEAE.**
- b. Leaves rudimentary or minute or scalelike, not circinate in veneration; sporangia borne at the axils of leaves or in strobili terminating the branches or the main axis.
 - l. Stems hollow and conspicuously jointed; leaves forming a sheath at stem nodes; branches whorled or none **EQUISETACEAE.**
 - l. Stems solid, not jointed; leaves rudimentary or lacking or, if present, not sheathing at nodes; branches dichotomous or subdichotomous.
 - m. Leaves numerous, conspicuous, in several ranks; sporangia single, unilocular, bivalvate **LYCOPODIACEAE.**
 - m. Leaves (in ours) few and rudimentary, or essentially lacking; sporangia fused into a tri-locular synangium **PSILOTACEAE.**
- a. Plants heterosporous, bearing both microspores (male) and megaspores (female).
 - n. Plants free-floating on water, the roots trailing. **SALVINIACEAE.**
 - n. Plants not free-floating (if aquatic, then rooted in mud).
 - o. Leaves (in ours) 4-foliolate, commonly floating on the water; sporangia borne in stalked, hardened, nutlike sporocarps near petiole base **MARSILEACEAE.**

- o. Leaves simple; sporangia borne in the axils of scalelike leaves or imbedded in the broadened bases of subulate leaves.
- p. Stem cormlike, subterranean, bearing simple, long-subulate, quill-like or rushlike leaves, commonly partly or wholly immersed in water; sporangia imbedded in the imbricate leaf bases. ISOETACEAE.
- p. Stem pinnately- or subdichotomously-branched, the branches and main stem bearing numerous, minute leaves (plants sometimes of wet places, but not normally immersed in water); sporangia borne in axils of leaves which are arranged in terminal strobili SELAGINELLACEAE.

OPHIOGLOSSACEAE

References: L. M. Underwood and R. C. Benedict, Ophioglossaceae, in North Amer. Fl. 16: 3-13. 1916. Robert T. Clausen, A monograph of the Ophioglossaceae, Mem. Torrey Bot. Club 19: 1-177. 1938.

Small, terrestrial, or, rarely epiphytic herbs; rhizome hypogean, short, usually erect, with the thick, fleshy, mycorrhizal roots lacking root hairs; stipular sheaths present at the base of the leaf; leaves solitary or few, erect or pendent, not circinate in vernation (or only folded over), dimorphic, or (in ours) with a common stalk bearing a foliaceous sterile lamina and one or several non-foliaceous fertile segments; sterile lamina stalked or sessile, simple to decompound, with free or reticulate venation; fertile segments spicate or paniculate; sporangia developed from a group of epidermal and subepidermal cells, in two rows on the surface of axes of the panicles or immersed in the tissue of the spike, with walls several cells thick, lacking an annulus, dehiscent into two valves by a transverse slit; spores uniform, trilete, numerous, from 1,500 to 15,000 in each sporangium.

The family Ophioglossaceae, containing three genera and about 50 species, differs from the true ferns (Filicales) in several important respects: the erect or curved, rather than circinate, vernation, the stipular sheaths, the large thick-walled sporangia, and the fleshy leaf texture, which is due to the complete lack of sclerenchymatous tissue. The Ophioglossaceae are widely distributed throughout the world, with representation in arctic as well as tropical regions. Some of the species have wide and disjunct distributions, e.g., *Botrychium lunaria* has been reported in such diverse areas as Greenland, Argentina, Siberia, and New Zealand. Several species of *Ophioglossum* are pan-tropical. The family has no economic importance. Two of the three genera are represented in Guatemala.

- a. Sterile lamina ternately decompound; veins free; sporangia borne in a panicle, free from each other and not immersed in the fertile segment *Botrychium*.
- a. Sterile lamina entire, or palmately or digitately lobed; veins reticulate; sporangia borne in a spike, fused laterally and immersed in the fertile segment *Ophioglossum*.

BOTRYCHIUM Swartz

References: J. Milde, *Botrychiorum monographia*, Verh. Zool. Bot. Ges. Wien 19: 55-190. 1869. F. K. Butters, *Botrychium virginianum* and its American varieties, Rhodora 19: 207. 1917.

Terrestrial herbs; rhizome hypogean, the bud for the following season partly or wholly enclosed within the base of the common stalk; leaves one or two, sparsely pubescent; sterile lamina sessile to long-stalked, ternately decompound or nearly so, the basal pinnae much longer and broader than the others, sometimes nearly as large as the rest of the lamina; venation pinnate, free; fertile segment a solitary, long-stalked, once- to thrice-pinnate panicle; sporangia protruding from the surface of the panicle, not immersed in the tissue.

The genus *Botrychium* contains about 25 species, with distribution in temperate to tropical regions in both hemispheres.

- a. Sterile lamina sessile or nearly so *B. virginianum* var. *mexicanum*.
- a. Sterile lamina long-stalked.
 - b. Segment tips rounded or truncate; ultimate segments widely spaced, with broad, mostly rounded sinuses *B. underwoodianum*.
 - b. Segment tips acute or subacute; ultimate segments mostly crowded, joined by narrow, acute sinuses *B. dissectum* ssp. *decompositum*.

Botrychium dissectum Sprengel ssp. *decompositum* (Mart. & Gal.) Clausen, Mem. Torrey Bot. Club 19: 58. 1938. *B. decompositum* Mart. & Gal. Nouv. Mém. Acad. Roy. Sci. Bruxelles 15: 51. t. 1. 1842.

Grassy, open places or partly open forests, 900-2,200 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Huehuetenango; Jalapa; Zacapa. United States (Louisiana); Mexico; Honduras; Costa Rica; Panama.

Mature plants 22-50 cm. high; common stalk 2-4 cm. long; stalk of the sterile segment 8-30 cm. long; sterile lamina 5-15 cm. long and 9-22 cm. broad, deltoid, or roughly pentagonal, subternately decompound; pinnae (except the enlarged, more highly dissected basal pair) pinnatisect to once-pinnate, very rarely pinnate-pinnatisect, with their tips commonly elongate; costae diverging from the rachis at a relatively narrow angle (about 45°); ultimate segments 6-16 mm. long, crowded, joined by narrow, acute sinuses, ovate, oblong, or lanceolate, obtuse to acute, their margins irregularly serrate to crenate; fertile stalk 15-32 cm. long, panicle 2- or 3-pinnate.

In his monograph, Clausen reported *B. schaffneri* Underwood (*Seler* 2738) from Guatemala, citing the specimen at the U. S. National Herbarium. However, he also cited the collection with this same number at the N. Y. Botanical Garden as *B. dissectum* ssp. *decom-*

positum. Examination of both specimens now supports the latter identification; thus there is still no documented record of *B. schaffneri* from Guatemala.

The leaves of *ssp. decompositum* vary widely in their shape and cutting throughout the range. Although the typical plant can easily be distinguished from *B. underwoodianum*, there are atypical plants, as well as some with immature leaves, which could be confused. Additional characteristics are discussed under *B. underwoodianum* Maxon.

It is possible that there are two different elements included in *B. dissectum* in Guatemala. One of these, presumably typical *decompositum*, cannot be matched by any plants from the United States or Canada, where *B. dissectum* occurs in many forms. In contrast, there is a collection from Guatemala (*Hatch & Wilson 264*), as well as another from Honduras, which *can* be closely matched by specimens from temperate North America. This is a form in which the segments are sharply angular and rhomboidal, perhaps approaching *forma obliquum* (Muhl.) Fern. Specimens of remarkably similar appearance were discovered by Dr. W. D. Reese of Southwestern Louisiana University, growing in more or less dry rises in bayous west of New Orleans. More material was later gathered by Dr. Reese and Dr. W. H. Wagner, Jr. (University of Michigan), which I examined at the herbarium in Ann Arbor. Some of the Louisiana specimens cannot be distinguished from the collections cited from Central America.

Furthermore, the identity of a number of specimens of *B. dissectum* with more highly divided leaves and exceptionally small ultimate segments is still in doubt. (As indicated above, some Mexican material has been misidentified as *B. schaffneri*.) Much more study is needed in Section *Sceptridium* of the genus, particularly study of mass collections from Mexico and Central America, before a more precise classification of the group is possible.

Botrychium underwoodianum Maxon, Bull. Torrey Bot. Club 32: 222. 1905.

Forested slopes, 1,150-3,500 m. Huehuetenango; Zacapa. Honduras; Costa Rica; Venezuela; Jamaica.

Mature plants 22-53 cm. high; common stalk 1.5-3.5 cm. long; stalk of the sterile segment 8-28 cm. long; sterile lamina 8-14 cm. long and 11-16 cm. broad, deltoid or roughly pentagonal, decompound; pinnae (except enlarged basal ones) pinnate-pinnatisect to twice-pinnate, divided nearly to their tips, these not particularly elon-

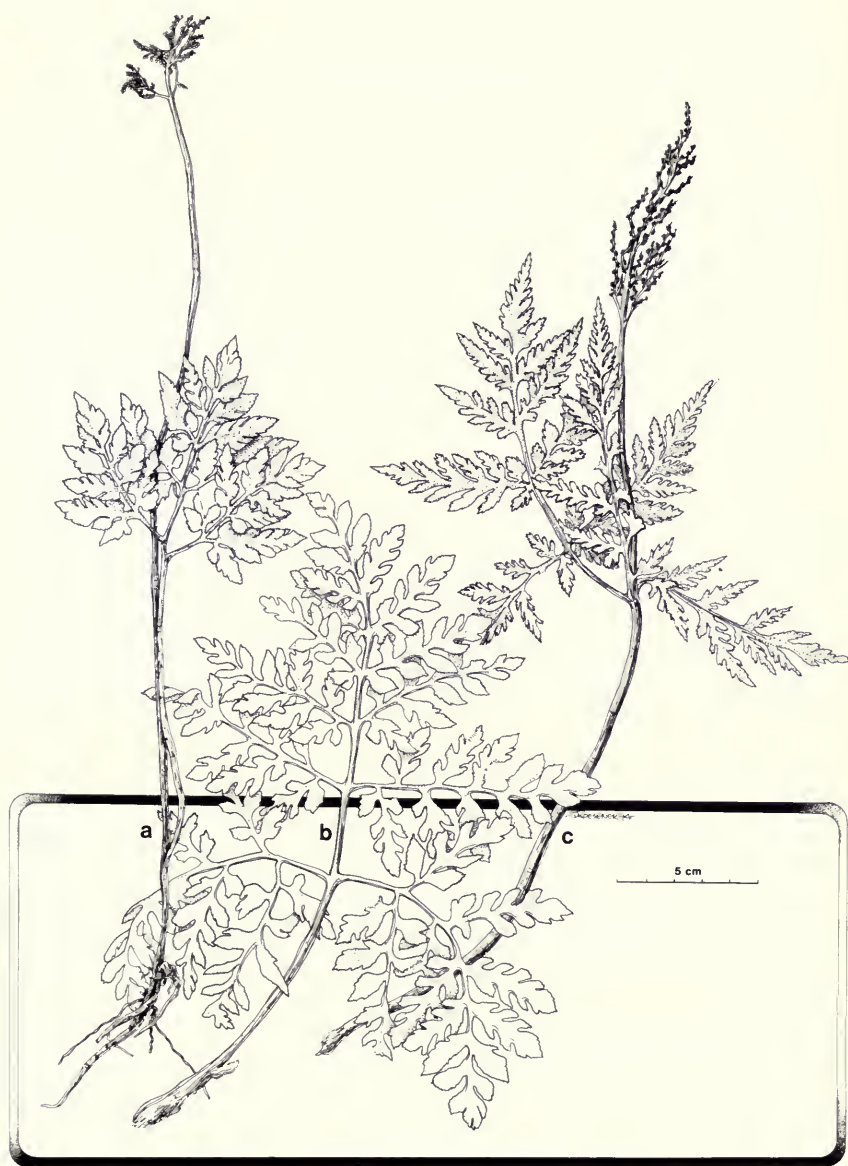


FIG. 1. *Botrychium*, habit, $\times \frac{1}{2}$. a, *B. dissectum* ssp. *decompositum*; b, *B. underwoodianum* (sterile lamina only); c, *B. virginianum* var. *mexicanum*.

gate; costae, especially of lower pairs of pinnae, diverging from rachis at a broad angle (60-90°), at least in dried specimens; ultimate segments 7-14 mm. long, widely spaced, with broad, mostly rounded sinuses, oblong, obovate or subspathulate, truncate, obtuse or (rarely) subacute, their margins irregularly serrate to crenate; stalk of the fertile segment 16-29 cm. long, panicle 2- to 3-pinnate.

In addition to the characters used in the key, there are other characters which are often helpful in separating *B. underwoodianum* from *B. dissectum* ssp. *decompositum*. In the latter the tips of the ultimate segments are mostly acute or subacute, and the costae diverge from the rachis at a relatively narrow angle, averaging about 45°. In *B. underwoodianum*, the tips of the ultimate segments are commonly rounded to truncate, and the costae diverge from the rachis at a broader angle (from 60-90°). Wagner, however, who has made frequent field studies of *Botrychium*, cautions against using the costa angle in determination of dried material, suggesting that this may be artificially induced in pressing.

Botrychium virginianum (L.) Swartz var. *mexicanum* Grev. & Hook., in Hooker's J. Bot. Kew Gard. Misc. 3: 223. 1833 (as *B. virginicum* beta *mexicanum*). *B. cicutarium* (Savigny) Sw., Syn. Fil. 171. 1806. *B. brachystachys* Kunze, Linnaea 18: 305. 1844.

Wet forests and wooded slopes, 900-3,800 m. Alta Verapaz; Chimaltenango; Guatemala; Jalapa; El Progreso; Quezaltenango; San Marcos; Sololá; Suchitepéquez; Zacapa. Mexico; Costa Rica; Panama; Greater Antilles; Venezuela and Colombia south to Bolivia and Brazil; Old World.

Mature plants 29-55 cm. high; common stalk 19-30 cm. long; sterile lamina sessile or short-stalked (to 2 mm.) to 21 cm. long and 24 cm. broad, deltoid, ternately divided or essentially so, with the lowest pinnae commonly much longer than the others; pinnae (except enlarged basal ones) mostly pinnate-pinnatisect; ultimate segments 4-9 mm. long, more or less crowded, joined by narrow, acute sinuses, elliptic, oblong or obovate, truncate, rounded or subacute, their apices variously toothed or lacerate; fertile stalk 5-15 cm. long, with panicle 3-12 cm. long, pinnate to bipinnate.

In his monograph, Clausen suggested that *B. cicutarium* might well be considered a subspecies of *B. virginianum*, a species which occurs in parts of the Old World and in the western hemisphere from Canada to Mexico. The two had been traditionally separated on the basis that the latter has fertile segments greatly exceeding the sterile blade in length, the blades are more highly dissected, and the plants produce two leaves in a season; whereas in *B. cicutarium* the fertile segments exceed the sterile slightly or not at all, the sterile blade is not as highly dissected, and only one leaf is produced in a

season. When studying many collections, one may note that temperate zone plants *generally* possess such characters thus attributed to *B. virginianum*, while plants from Mexico southward *generally* have characters aligned with *B. cicutarium*. Hence it still may be prudent to maintain a distinction at this time, even if not at the species level.

Since Clausen's monograph, more tropical American collections have been made in many areas, offering further evidence that the two taxa are conspecific. The characteristics are extremely variable, so that a number of plants of *B. virginianum*, in the United States, for example, have the fertile segments equal to or only slightly exceeding the sterile blade. Conversely, some plants have been collected in Central America with their fertile segments far exceeding the sterile. Likewise, the degree of dissection may vary to some extent throughout the range of both species. Greville and Hooker chose to assign varietal status to Mexican and Central American plants of *B. virginianum*, a view which was shared by a number of other authors, including Chamisso, Schlechtendal, Milde, and Torrey. I consider this classification more appropriate and quite consistent with the subspecific status currently recognized in other comparable taxa in the genus. As with the *B. dissectum* complex, further field work, especially mass population studies, will be necessary to effect a proper understanding of the relationships of the taxa.

OPHIOGLOSSUM Linnaeus

Terrestrial or epiphytic herbs; rhizome hypogean, with the bud for the following season exposed at the base of the common stalk; leaves solitary or few, glabrous; sterile lamina sessile or short-stalked, entire or palmately- to digitately lobed; venation reticulate, the primary areoles enclosing free veinlets and/or smaller, secondary areoles; fertile segments consisting of one to several, stalked, slender spikes arising from the apex of the common stalk or from the base of the sterile blade; sporangia coalescent, immersed in the tissue of the spike.

Approximately 25 species of *Ophioglossum* are scattered widely around the earth. Four species are found in Guatemala, one of which is represented by two varieties. A fifth is also to be expected in Guatemala.

- a. Sterile lamina palmately or digitately lobed; fertile segments several, arising from the upper part of the stalk or lower part of the sterile lamina. . *O. palmatum*.
- a. Sterile lamina entire; fertile segment solitary, arising at base of sterile lamina.
 - b. Pale, median band of tissue and midvein extending nearly to apex of sterile lamina; veins forming areoles which enclose smaller secondary areoles as well as free veinlets *O. ellipticum*.

- b. Pale, median band and midvein lacking; veins forming areoles not enclosing secondary areoles, but often with included free veinlets.
- c. Rhizome conspicuously globose. *O. crotalophoroides*.
- c. Rhizome cylindrical to somewhat swollen, but never globose.
- d. Common stalk 3-12 cm. long, lamina usually arising from middle of plant *O. reticulatum*.
- d. Common stalk not over 2.5 cm. long, lamina arising from base of plant.
- e. Base of lamina cuneate to short attenuate
O. nudicaule var. *tenerum*.
- e. Base of lamina truncate to subcordate, usually clasping
O. nudicaule var. *vulcanicum*.

Ophioglossum crotalophoroides Walter, Fl. Carolin. 256. 1788.

Moist, grassy, open places, 900-3,000 m.; Chiquimula; Huehuetenango; [Chimaltenango; Zacapa, fide Morton]. Southern United States; Mexico; [Honduras, fide Morton]; Colombia; Peru; Bolivia; Uruguay.

Plants terrestrial; rhizome globose, bearing one or (commonly) two leaves; mature plant 3.5-13 cm. tall; common stalk 0.5-3.5 cm. long; fertile segment 2-11 cm. long, with spike 0.5-1.5 cm. long and 1-3.5 mm. thick; sterile lamina 1-4.5 cm. long and 0.8-2 cm. wide, ovate to deltoid, acute or rarely obtuse, cordate or truncate and abruptly attenuate at base, lacking a pale, median band of tissue and distinct midvein (or, rarely, a poorly defined midvein present near the base); venation indistinct, diffuse, reticulate, the areoles occasionally with included free veinlets.

Among the diminutive species of *Ophioglossum*, occasional plants may be found with rhizomes which are quite swollen. However, only in *O. crotalophoroides* is the rhizome so conspicuously globose.

Ophioglossum ellipticum Hook. & Grev. Icon. Filicum 1: t. 40A. 1831.

Wet, grassy, mostly open places, 1,400-1,600 m.; Jalapa. British Honduras; Honduras; Costa Rica; the Guianas southward to Brazil and Bolivia.

Plants terrestrial; rhizome thick-cylindrical, bearing two to several leaves; mature plant 4-16 cm. tall; common stalk 0.6-3.5 cm. tall; fertile segment 3-14 cm. long, with spike 1-2.5 cm. long and 1.2-3 mm. thick; sterile lamina 1.5-6 cm. long and 0.6-1.7 cm. wide, elliptic, acute to rarely obtuse, cuneate to short-attenuate at base, with a distinct midvein and pale, median band of tissue (the latter often becoming indistinct at the apex); venation rather distinct, diffuse, with somewhat raised veins forming elongate, primary areoles, which contain numerous secondary areoles and often free, included veinlets.

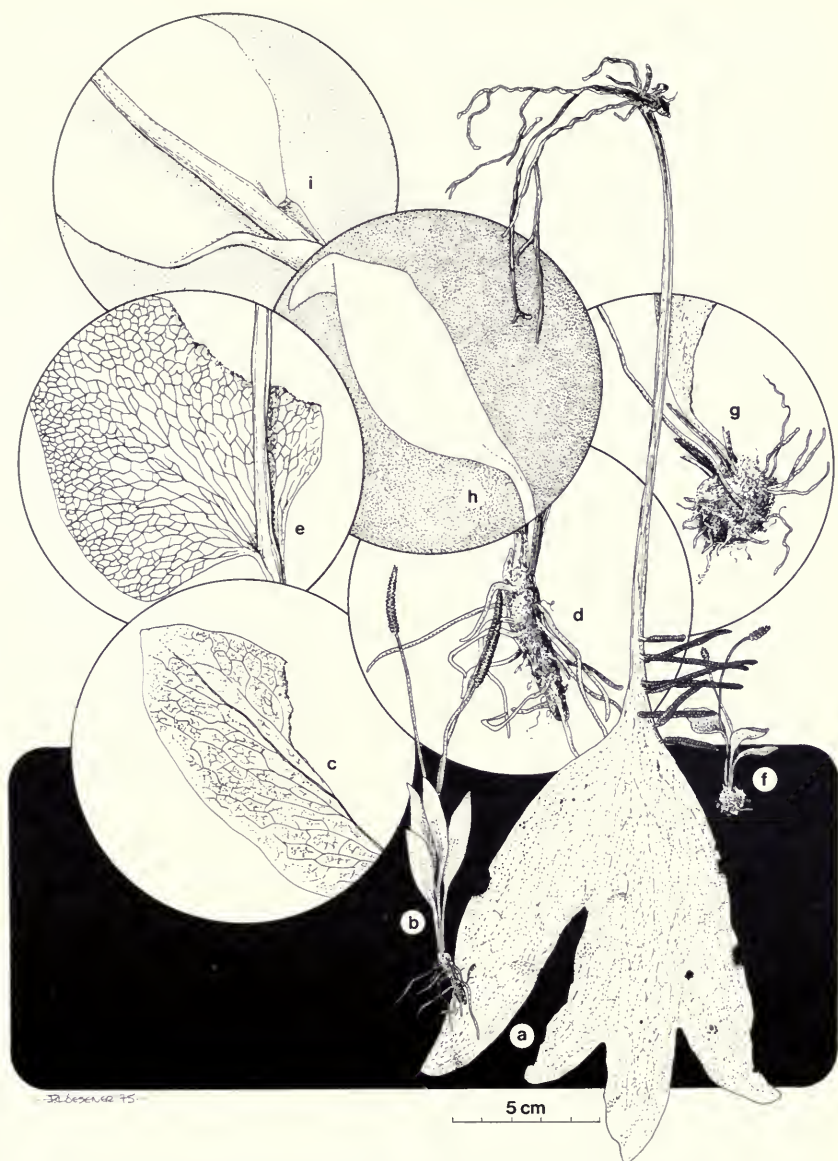


FIG. 2. *Ophioglossum*. a, *O. palmatum*, habit, $\times \frac{1}{2}$; b-d, *O. ellipticum*: b, habit, $\times \frac{1}{2}$; c, portion of lamina, showing venation, $\times 2\frac{1}{2}$; d, rhizome, $\times 1\frac{1}{2}$; e, *O. reticulatum*, portion of lamina, showing venation, $\times 2$; f-g, *O. crotalophoroides*; f, habit, $\times \frac{1}{2}$; g, rhizome, $\times 1\frac{1}{2}$; h, *O. nudicaule* var. *tenerum*, lamina outline, $\times 5$; i, *O. nudicaule* var. *vulcanicum*, base of lamina, $\times 10$.

The pale, median band of tissue and the double-areolate venation are characters which easily distinguish *O. ellipticum* from all other species of the genus in Guatemala.

Ophioglossum nudicaule L. f. var. **tenerum** (Mett. ex Prantl) Clausen, Mem. Torrey Bot. Club 19: 146. 1938. *O. tenerum* Mett. ex Prantl, Ber. Deutsch. Bot. Ges. 1: 352. 1883.

Moist, grassy, open places or open pine barrens, 200-2,100 m.; Zacapa. Georgia, Florida; Hispaniola; Colombia; French Guiana; Bolivia; Old World.

Plants terrestrial; rhizome thick-cylindrical to swollen, but never globose, bearing one to two leaves; mature plant 2-11.5 cm. tall; common stalk 0.5-2.5 cm. long; fertile segment 1.5-9 cm. long, with spike 0.3-1.5 cm. long and 1-2 mm. thick; sterile lamina 0.5-2.5 cm. long and 0.2-0.8 cm. wide, elliptic to ovate, acute to rarely obtuse, cuneate to short-attenuate at base, with midvein lacking or very poorly defined; venation somewhat obscured due to the thickened texture, diffuse, reticulate, the areoles mostly with free, included veinlets.

Clausen pointed out in his monograph that, on the basis of a few intermediate plants collected in Africa, the separation of *O. nudicaule* var. *tenerum* from the typical variety might not be justifiable. In either case, the plants in Guatemala are separable from those of var. *vulcanicum*, as is designated in the key.

Ophioglossum nudicaule L. f. var. **vulcanicum** Clausen, Mem. Torrey Bot. Club 19: 150. 1938.

Open meadows on slopes of volcanos, 2,800-3,700 m.; Huehuetenango. Panama.

Plants terrestrial; rhizome cylindrical, bearing one or two leaves; mature plant 3-5 cm. tall; common stalk 0.5-2 cm. long; fertile segment 2-4.5 cm. long, with spike 0.5-1 cm. long and 1.5-2.5 mm. thick; sterile lamina 0.8-1.7 cm. long and 0.4-0.7 cm. wide, ovate to suborbicular, acute or often subapiculate, base truncate to subcordate, usually clasping, with midvein lacking; venation somewhat obscured due to the thickened texture, diffuse, reticulate, the areoles mostly with free, included veinlets.

Ophioglossum palmatum L. Sp. Pl. 2: 1063. 1753. *Cheiroglossa palmata* (L.) Presl, Suppl. Tent. Pterid.: 57. 1845. *Ophioderma palmata* (L.) Nakai, Bot. Mag. (Tokyo) 39: 193. 1925.

Not yet collected in Guatemala, there is good reason to expect it there. It is a rather rare fern in all the regions in which it has been found. Deep shade of forests, on tree trunks, branches, stumps, 0-2,500 m. Florida; West Indies; Honduras; Costa Rica; Colombia; British Guiana; Brazil; Ecuador; Peru.

Plants epiphytic, with fleshy leaves pendent or spreading; rhizome stout, bearing one to several leaves; rhizome and petiole base densely covered with broad, pale, tawny or reddish scales, which are long-fringed and hairlike for most of their length; mature plant 24-100 cm. long; common stalk 15-50 cm. long; fertile segments 1 to 8, borne on upper stalk or base of leaf, with fertile spikes 1.5-4.5 cm. long and 2-4 mm. thick, borne on short stalks 0.2-1.8 cm. long; sterile lamina 10-50 cm. long and 9-26 cm. wide, lacking a midrib, palmately or digitately lobed, with apices of lobes obtuse to acute, leaf base cuneate to attenuate; venation evident, reticulate, with free, included veinlets and/or secondary areoles enclosed by larger, primary areoles.

***Ophioglossum reticulatum* L. Sp. Pl. 2: 1063. 1753.**

Open pastures, moist open slopes and thickets, 1,000-2,500 m.; Chiquimula; Huehuetenango; Jalapa [Alta Verapaz, fide Morton]. Southern Mexico; Honduras; Costa Rica; West Indies; Colombia and Venezuela southward to Bolivia; Old World tropics.

Plants terrestrial; rhizome erect, cylindrical, commonly bearing a single leaf; mature plant 7-34 cm. tall; common stalk 3-12 cm. long with spike 1.2-5.5 cm. long and 2-3.5 mm. thick; sterile lamina 2-8 cm. long, 1.2-5.2 cm. wide, ovate, deltoid or subreniform, obtuse to acute, base cordate, truncate, often short- to long- (12 mm.) attenuate, with midvein lacking; venation evident, diffuse, reticulate, the areoles commonly with free, included veinlets.

The fact that plants of this species are so much larger, and therefore more conspicuous, than those of *O. nudicaule* and *O. crotalophoroides*, perhaps accounts for its greater representation in herbaria. However, more careful searching for all the species of the genus will certainly reveal a much wider distribution of the individual taxa.

MARATTIACEAE

Reference: L. M. Underwood, Marattiaceae, in North Amer. Fl. 16: 15-23. 1916.

Terrestrial plants with fleshy, creeping or erect rhizomes; leaves small to huge, circinate in vernation, usually compound, occasionally dimorphic, stipulate, petiole swollen and articulate at the rhizome; lamina coarse, with pinnae jointed to the rachis, often with swollen nodes; venation free, or rarely reticulate; sporangia borne on the abaxial surface of the leaves, with walls several cells thick, lacking an annulus, separate and contiguous or coalescing into thick, circular or (in ours) elongate, double-rowed synangia, and opening by terminal pores or longitudinal slits; spores uniform, monolete or trilete, numerous (1,500-7,000) in each sporangium.

This distinctive and natural family is pantropic in distribution. Of the six or seven recognized genera, only two occur in the New World, and both of these are represented in Guatemala. The family is of no economic importance.

- a. Leaves 1-pinnate, dimorphic; synangia nearly covering the abaxial surface of the fertile pinnae *Danaea*.
- a. Leaves 3-pinnate, uniform; synangia scattered, borne near the ends of the veins..... *Marattia*.

DANAEA J. E. Smith

Reference: L. M. Underwood, A review of the genus *Danaea*, Bull. Torrey Bot. Club 29: 669-679. 1902.

Plants terrestrial, with rhizomes horizontal or obliquely ascending; leaves distichous, dimorphous, simple or (in ours) 1-pinnate; primary axis nodose, the lower nodes often lacking pinnae, provided with reddish, appressed, peltate, often suborbicular scales; sterile pinnae subfalcate, sessile or short-stalked (to 5 mm.), slightly undulate and entire, or serrate near the acuminate or caudate apex; lamina provided with scales on the costae and tissue beneath, those of the tissue commonly fimbriate, widely scattered and extremely minute, veins free, paired or once-forked at or near the costa; fertile pinnae similar in shape to the sterile ones, but somewhat reduced in size; sporangia nearly covering the abaxial surface, coalescing into elongate, double-rowed synangia which open by terminal pores; spores monolete.

A distinctive genus, confined to the American tropics, easily recognized by the nodose axes, dimorphous leaves with mostly opposite pinnae, synangia nearly covering the fertile pinnae beneath, and the usually once-pinnate blades. Of the 30-35 species in the genus, only three are known from Guatemala.

- a. Petiole lacking nodes; larger sterile pinnae 20-40 cm. long; synangia more than 150 pairs on each fertile pinna. *D. nodosa*.
- a. Petiole nodose; sterile pinnae commonly less than 20 cm. long; synangia less than 100 pairs on each fertile pinna.
 - b. Sterile pinnae 6 pairs or less, larger ones 3-4.5 cm. broad, subentire throughout; not found over 600 m. *D. elliptica*.
 - b. Sterile pinnae 10-18 pairs, not more than 2 cm. broad, serrate at apex; 1,200-2,100 m. *D. cuspidata*.

Danaea cuspidata Liebm., Kongel. Danske Vidensk. Selsk. Skr. V. (1): 307 (seors. 155). 1849.

Wet forest floor, often in shaded ravines, 1,200-2,100 m. Alta Verapaz; Baja Verapaz; Huehuetenango. Southern Mexico; Costa Rica; Panama.

Plants to 1 m. tall, terrestrial, occasionally climbing; primary axis with several nodes below the lamina; lamina with 10-18 pairs of pinnae, larger sterile ones 9-12 cm. long, 1.5-2 cm. broad, narrow-elliptic or -oblong, with base obtuse, truncate or broadly cuneate, apex serrate, acuminate; laminar scales widely scattered along the veins and on the tissue beneath, minute, suborbicular, entire to erose; fertile pinnae similar in shape to sterile ones, 4.5-8 cm. long, 0.6-0.8 cm. broad; synangia ca. 100 pairs per pinna.



FIG. 3. *Danaea*, habit (sterile leaves). a, *D. cuspidata*, $\times \frac{1}{2}$ (inset $\times 1\frac{1}{2}$); b, *D. elliptica*, $\times \frac{1}{2}$; c, *D. nodosa*, $\times \frac{1}{2}$.

A minute but interesting feature of our species of *Danaea* may be found on the veins and tissue of the abaxial side of the pinnae. What at first appear to be widely scattered, red resin dots are revealed (under high magnification) to be microscopic scales 0.1 mm. or less. Reddish, appressed, suborbicular and peltate, they are similar to the larger scales of the primary axis. Those of *D. cuspidata*, however, have subentire to erose margins, whereas those of *D. elliptica* and *D. nodosa* are commonly fimbriate, often so deeply that they present a stellate appearance.

Danaea elliptica J. E. Sm., in Rees Cycl. 11: *Danaea* No. 2. 1808. *D. media* Liebm., Kongel. Danske Vidensk. Selsk. Skr. V (1): 306. 1849.

Moist ground, in forests, 60-600 m. Alta Verapaz; Huehuetenango. West Indies; southern Mexico; British Honduras; Honduras; Nicaragua; Costa Rica; Panama; the Guianas; Colombia; Brazil; Peru; Bolivia.

Plants to 1 m. tall, terrestrial; primary axis with several nodes below the lamina; lamina with six pairs of pinnae or less, larger sterile ones 12-20 cm. long, 3-4.5 cm. broad, narrowly oblanceolate to mostly elliptic, margin subentire throughout, with base cuneate, apex acuminate; laminar scales minute, suborbicular, mostly fimbriate, widely scattered along the veins and on the tissue beneath; fertile pinnae similar to sterile ones in shape, 9.5-11.5 cm. long, 2.3-2.8 cm. broad; synangia ca. 90-100 pairs per pinna.

Danaea nodosa (L.) J. E. Sm. Mém. Acad. Roy. Sci. (Turin) 5: 420. 1793. *Acrostichum nodosum* L., Sp. Pl. 1070. 1753.

Low wet ground, often in ravines, in forests, sea level to 950 m. Alta Verapaz; Izabal. West Indies; southern Mexico; British Honduras; Honduras; Nicaragua; Costa Rica; Panama; southward to Peru and Brazil.

Plants to 2 m. tall, terrestrial; petiole lacking nodes; lamina with 7-11 pairs of pinnae, larger sterile ones 20-40 cm. long, to 4.5 cm. broad, narrowly elliptic, oblong, or oblanceolate, margin subentire throughout, broadly cuneate at base, with an acuminate to caudate apex; laminar scales minute, suborbicular, mostly fimbriate, widely scattered along the veins and on the tissue beneath; fertile pinnae similar to the sterile ones in shape, to 26 cm. long and 2 cm. broad; synangia ca. 150-170 pairs per pinna.

MARATTIA Swartz

Plants terrestrial, with stout, erect rhizomes; leaves deltoid, 2- to 3-pinnate, or rarely 4-pinnate as to some of the larger pinnae, the fertile and sterile leaves alike;

A pantropical genus of about 50 species, centered chiefly in the East Indies. The problem of *Marattia* in Central America requires much closer examination and more field studies. A meaningful classification must be based on better and more complete collections. Most species with sessile synangia apparently differ only in characters of size and shape, and it is likely there are but one or two species where four or five have been previously recognized. Even size and shape are of questionable value in delimiting species, since tertiary segments vary between specimens in gradual, almost imperceptible stages, from short, narrow and obtuse, to long, broad, and acute to acuminate. Furthermore, most specimens currently available consist merely of a single pinna, with no label data as to where the pinna was located on the leaf. Obviously, the shape and size of tertiary segments of basal pinnae can differ greatly from those of pinnae near the leaf apex.

- a. Scales abundant on midribs and veins of tertiary segments *M. alata*.
- a. Scales lacking (or a few hairlike scales or trichomes widely scattered) on midribs and veins of tertiary segments.
 - b. Tertiary segments commonly acute to acuminate, larger ones 24-60 mm. long and 10-20 mm. broad *M. interposita*.
 - b. Tertiary segments rounded or truncate to subacute (or rarely a few segments acute), to 20 (25) mm. long and 10 mm. broad.
 - c. Larger tertiary segments 15-20 (25) mm. long and (6) 7-10 mm. broad.
 *M. excavata*.
 - c. Larger tertiary segments 11-15 mm. long and 4-6 (7) mm. broad
 *M. weinmanniifolia*.

Although this is essentially a West Indian species, at least one specimen (*Ghiesbreght 241*) has been found in Chiapas; hence it is

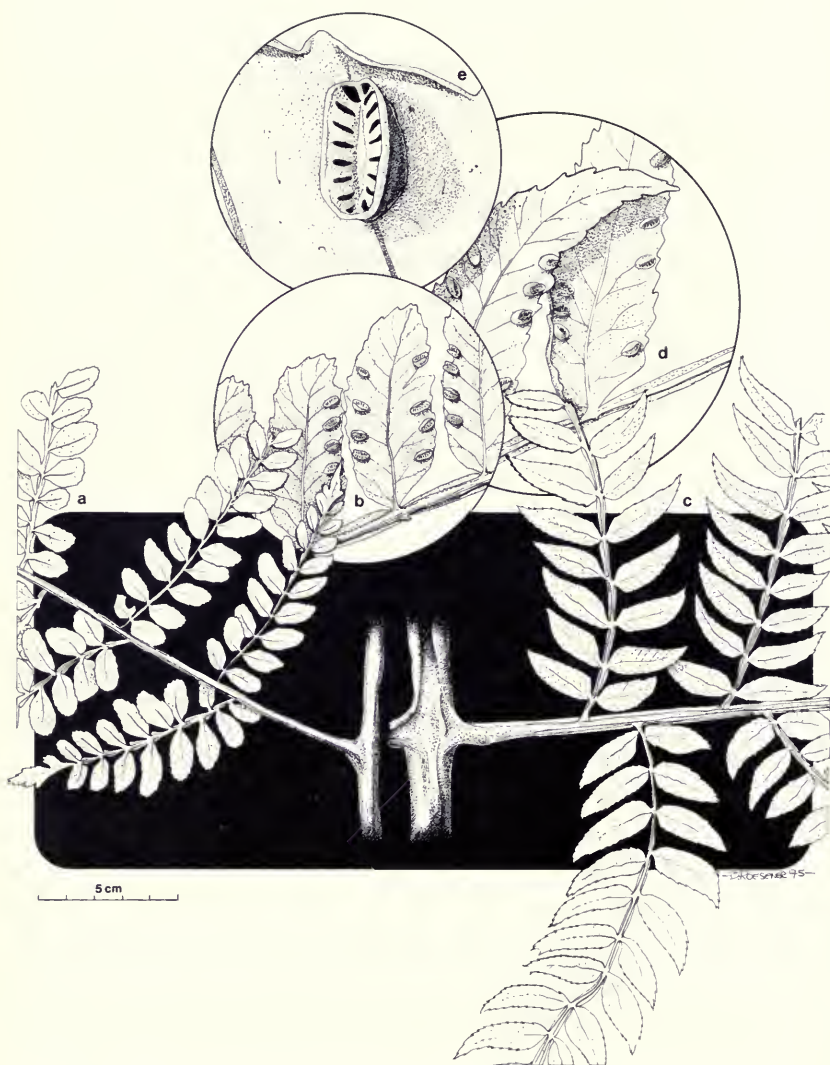


FIG. 4. *Marattia*. a-b, *M. excavata*: a, habit, $\times \frac{1}{2}$; b, ultimate segments, $\times 2$; c-e, *M. interposita*: c, habit, $\times \frac{1}{2}$; d, ultimate segments, $\times 2$; e, synangium, $\times 12$.

to be expected in Guatemala. Dense wet forests and wooded slopes, 1,100-1,800 m. Cuba; Jamaica; Hispaniola; southern Mexico.

Rhizome and petiole base not seen; upper petiole, rachis and costae sparsely provided with broad, mostly attenuate, orange- to red-brown scales; leaves several meters long, 3- (4-) pinnate, subcoriaceous, tissue glabrous and glands generally lacking above, glabrous beneath, but costules, midribs and veins rather thickly covered with rusty brown, broad, attenuate or hairlike scales; ultimate (tertiary) segments to 20 mm. long and 9 mm. broad, diminishing to 5 mm. long and 2 mm. broad at pinnule apices, subsessile, oblong or narrowly ovate, with apices rounded to acute, margin serrate (commonly deeply so), the bases somewhat obliquely excavate on the acroscopic side; veins of the tertiary segments simple to once-forked, commonly distinct; synangia 8- to 16-locular, submarginal or supramedial (rarely medial) on the segments, usually subtended by slender, brown scales.

Indument is a variable and inconsistent character among species of *Marattia*, and generally of little taxonomic value. However, broad, rusty-brown scales are so abundant on veins and midribs of segments in *M. alata* that it can be readily distinguished from all others in Guatemala, on this character alone. Indument, if any, found on veins and midribs of other species consists of minute, widely scattered trichomes or hairlike scales, which are sometimes detectable only under high magnification.

***Marattia excavata* Underw. North Amer. Fl. 16: 22. 1909.**

Dense, wet montane or cloud forests, 1,300-2,850 m., Alta Verapaz; Baja Verapaz; Quezaltenango; El Quiché; San Marcos; Suchitupéquez; Zacapa. Mexico (Chiapas); Honduras; El Salvador; Nicaragua; Costa Rica.

Rhizome erect, to 40 cm. tall; petiole base and croziers rather thickly invested with large, broad, yellowish brown to reddish brown scales; upper petiole, rachis and costae nearly glabrous, provided with scattered, broad, attenuate, pale to light brown scales or slender, tortuous, hairlike ones; leaves 2-3 m. long, commonly 3-pinnate, subcoriaceous, tissue glabrous above, sometimes thickly dotted with minute reddish or yellowish glands, glabrous beneath, or with pale to reddish brown, hairlike scales or tortuous trichomes scattered along the midribs and veins; ultimate (tertiary) segments to 20 (25) mm. long and 10 mm. broad, diminishing to 8 mm. long and 4 mm. broad at pinnule apices, sessile, oblong to narrowly ovate, often subfalcate, with apices rounded or truncate to subacute, margin serrate, the bases obliquely excavate on the acroscopic side; veins of the tertiary segments simple or once-forked, usually distinct, occasionally somewhat obscure; synangia 10- to 18-locular, supramedial to submarginal on the segments, sometimes sparsely subtended by hairlike scales.

This species lies midway between *M. weinmanniifolia* and *M. interposita* in size and shape. All other characters in the three taxa are highly variable and inconsistent, and it is likely that future monographic study will reveal that they are conspecific—varieties at

best. The tertiary segments of *M. weinmanniifolia* are relatively small and rounded, with simple to rarely once-forked veins that are commonly obscure. In *M. excavata*, the segments are somewhat larger, often subacute (rarely acute), with veins sometimes simple, but commonly once-forked, and usually quite distinct. The segments of *M. interposita* are extremely large, acute to long-acuminate, with veins often several-times forked. None of these characters appear, by themselves, to be taxonomically significant, and are rather a manifestation of the effect of increased size, due either to maturity of the individual plant or to ecological or geographical variation.

Marattia interposita Christ, Bull. Herb. Boissier II (6): 285. 1906. *Casco de burro, maigre maiz* (fide Steyermark, Quezaltenango).

Damp, usually dense, montane or cloud forests, or in forested quebradas, 1,300-2,800 m.; Baja Verapaz; Quezaltenango; San Marcos. Honduras; Costa Rica; probably Panama and Colombia.

Rhizome and petiole base not seen; upper petiole, rachis and costae mostly glabrous, or sparsely provided with broad to slender, usually attenuate, pale to brown scales; leaves to 2 m. long, 3- (4-) pinnate, subcoriaceous, tissue glabrous above, often thickly dotted with minute, reddish or yellowish glands, glabrous beneath, or with pale to brown hairlike scales or tortuous trichomes widely scattered along the midribs and veins; ultimate (tertiary) segments to 60 mm. long and 20 mm. broad, diminishing to 12 mm. long and 6 mm. broad at pinnule apices, subsessile, oblong to narrowly ovate, often subfalcate, with apices acute to acuminate, margin serrate, and the bases obliquely excavate on the acroscopic side; veins of the tertiary segments simple, or more commonly 1- or 2-(3-) forked, distinct to somewhat obscure; synangia 10- to 18-locular, mostly submarginal on the segments, rarely sparsely subtended by slender scales.

With this species should probably be included *M. chiricana* from Panama, which is said to differ in its greater size and larger, less marginal synangia.

It is said that the scaly rootstocks of *M. interposita* are sometimes cooked and eaten in times when the corn crop is poor. Also, croziers and petiole bases are reportedly cooked and mixed with tortillas.

Marattia weinmanniifolia Liebm. Kongel. Danske Vidensk. Selsk. Skr. V. 1: 308 (seors.156). 1849.

Dense, wet forest, 1,200-1,700 m. Alta Verapaz. Southern Mexico; Honduras; El Salvador. Type from Villa Alta, Oaxaca, Mexico, *Liebm. Fl. Mex.* 651.

Rhizome and petiole base not seen; upper petiole, rachis and costae sparsely to abundantly provided with broad and attenuate, or hairlike, brown scales; leaves to 2 m. long, commonly 3-pinnate, chartaceous to subcoriaceous, tissue glabrous and glands generally lacking above, glabrous beneath, or with a few brown trichomes or hairlike scales widely scattered on veins and midribs; ultimate (tertiary) segments to 16 mm. long and 6 mm. broad, diminishing to 5 mm. long and 2 mm. broad at pinule apices, sessile or subsessile, oblong to narrowly ovate, often subfalcate, with apices rounded to subacute, margins subentire to crenulate or serrate, the bases somewhat obliquely excavate on the acroscopic side; veins of the tertiary segments simple, or once-forked, faint or obscure (or rarely distinct); synangia 10- to 15-locular, inframedial to medial, or most commonly submarginal on the segments, sometimes sparsely subtended by hairlike scales.

OSMUNDACEAE

Reference: R. C. Benedict, Osmundaceae, in North Amer. Fl. 16: 27-28. 1916.

Coarse, terrestrial plants with woody, usually erect, rhizomes and hard, fibrous roots; leaves large, circinate in veneration, densely caespitose, petiole not articulate at the rhizome, pinnately compound, alike or (in ours) completely dimorphous or with dimorphous pinnae, with tissue at base of petiole expanded into sheathlike wings; venation free; sporangia not in definite sori, borne abaxially on the segments or (in ours) completely replacing the vegetative tissue of some pinnae or entire laminae, exindusiate, short-stalked, globose or pyriform, with walls one cell thick, annulus lacking or of only a few thickened cells near the distal end, longitudinally dehiscent; spores uniform, green, trilete, relatively numerous (120-512) in each sporangium.

Considered to be among the most primitive of families, with many characters evidently intermediate between the leptosporangiate and eusporangiate ferns; however it is quite distinctive and natural and has no close affinity with any other living fern family. The three (to five) genera of the Osmundaceae, containing 15-20 species, may be found in both tropical and temperate regions throughout the world, but the family is represented in the New World by only a few species of *Osmunda*.

OSMUNDA Linnaeus

Mature leaves quite coarse and large, pinnately compound, completely dimorphous or with dimorphous pinnae, arising in two rings from a stout rhizome, the inner ring fertile and developing first, with leaves mostly erect, the outer one sterile, with the leaves somewhat spreading; fertile leaves or pinnae lacking green leaf tissue; veins free, at least once-forked; leaf tissue commonly glabrous, but the axes often sparsely to moderately invested with trichomes on the adaxial side; rachis or costa (at least in ours) with a thin, green wing of tissue along each side, arising from the adax-

ial edges; sporangia relatively large, developing simultaneously, dark brown to reddish brown, densely crowded on the segments of the fertile blades.

The genus contains about 12 species which are generally found in swampy areas in temperate and tropical regions around the world. Larger rhizomes of *Osmunda*, with their dense mats of coarse roots, are widely used in the culture of orchids and other commercially popular epiphytes. Two species occur in Guatemala.

- a. Sterile laminae pinnate-pinnatisect; ultimate segments entire, the veins commonly once-forked; fertile laminae non-foliaceous throughout *O. cinnamomea*.
- a. Sterile laminae bipinnate; ultimate segments serrulate, the veins commonly twice-forked; fertile laminae non-foliaceous and fertile only in the apical portion *O. regalis* var. *spectabilis*.

Osmunda cinnamomea L. Sp. Pl. 1066. 1753. *O. bipinnata* L. Sp. Pl. 1065. 1753.

Mostly wooded swamps and bogs, 1,250-1,500 m.; Alta Verapaz. Eastern and central United States and Canada; southern Mexico; Honduras; Costa Rica; West Indies; Colombia; Venezuela; Brazil; Peru; Paraguay; Southeast Asia.

Mature leaves to 1.5 m. tall, completely dimorphous; petiole to 50 cm. long, stramineous to reddish brown, darker toward the base, glabrous or with some scattered, reddish brown, tortuous, pluricellular trichomes; sterile lamina to 80 cm. long and 20 cm. broad, elliptic to broadly lanceolate, pinnate-pinnatisect; texture chartaceous to subcoriaceous; rachis stramineous to light brown, with scattered trichomes, a thin wing of tissue connecting adjacent pinnae; pinnae to 13 cm. long and 2 cm. broad, spreading to strongly ascending, subopposite, articulate at rachis, reddish brown trichomes scattered along the costa and in very dense clusters at pinna base; ultimate segments to 1 cm. long and 0.6 cm. broad, cut nearly to costa, subfalcate, obtuse to subacute, margins entire and bearing abundant minute trichomes; veins once-forked; fertile leaves bipinnate due to reduction of leaf tissue, very narrow (pinnae to 3 cm. long), rachis generally darker-colored than that of sterile pinnae and with a greater abundance of trichomes; trichomes very thick among the crowded, dark reddish brown sporangia.

Osmunda regalis L. var. *spectabilis* (Willd.) Gray, Manual, ed. 2: 600. 1856. *O. spectabilis* Willd. Sp. Pl. 5: 98. 1810. *O. mexicana* Fée, Mem. Fam. Foug. 9: 43. 1857.

In wet thickets, wooded swamps, and along shaded river banks, 1,200-2,100 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Huehuetenango; El Quiché; Santa Rosa. Eastern and central United States and Canada; West Indies; southern Mexico; Honduras; Costa Rica; Colombia; Venezuela; Brazil; Ecuador; Peru; Paraguay; Uruguay; Old World.



FIG. 5. *Osmunda*. a-b, *O. regalis* var. *spectabilis*: a, habit, $\times \frac{1}{2}$; b, ultimate segment, $\times 2\frac{1}{2}$; c-d, *O. cinnamomea*: c, habit, $\times \frac{1}{2}$; d, ultimate segment, $\times 2\frac{1}{2}$.

Mature leaves to 1.8 m. tall, partly dimorphous, fertile leaves with fertile and sterile portions combined on the same blade, the fertile pinnae commonly apical; petiole glabrous, to 75 cm. long, stramineous or light brown to reddish brown, usually darkest toward the base; sterile blade to 80 cm. long and 35 cm. broad, elliptic or oblong, bipinnate, chartaceous to subcoriaceous, tissue glabrous; rachis stramineous or light brown, non-alate, glabrous, or with minute trichomes scattered widely on the adaxial side; pinnae to 30 cm. long, strongly ascending, subopposite, articulate at rachis, with trichomes of two kinds, minute (0.1-0.2 mm.), light brown, mostly unicellular ones scattered along the adaxial side of the costae and costules, and some longer (to 1 mm.), tortuous, reddish brown, pluricellular ones clustered at the bases of pinnules; costae narrowly alate (best observed from adaxial side); pinnules distant, short-stalked and articulate at the costae, subopposite, 7 to 15 pairs per pinna, 1.5-5.5 cm. long and 0.5-1.7 cm. broad, oblong to narrow-elliptic, obtuse to acute, broadly rounded or, more commonly, truncate at base, margins serrulate; veins mostly twice-forked; fertile pinnae essentially bipinnate, the crowded, reddish brown sprogia almost completely replacing the tissue.

This variety differs from the typical in its narrower, more coriaceous leaves, broader panicles, and rachis glabrous or with dark-colored trichomes only at the bases of pinnules and (rarely) pinnae. The typical variety, occurring in parts of Eurasia, has black, hair-like scales more or less persistent along the rachis. Some workers also separate the South American and southern Central American representatives of var. *spectabilis* into yet another variety, *palustris* Schrad., based on the size of the segments and length of their stalks. However, these characters appear to be too variable and inconsistent to provide sufficient varietal distinction.

SCHIZAEACEAE

References: K. Prantl, *Untersuch. Morph. Gefässkrypt. II: Schizaceen*, W. Engelmann, Leipzig, 1881; W. R. Maxon, *Schizaeaceae*, in *North Amer. Fl.* 16: 31-52. 1909.

Coarse to delicate, terrestrial plants of highly diverse habit and shape, with rhizomes oblique, ascending or horizontal, sometimes short- or long-creeping (dichotomously branched in *Lygodium*), rather densely clothed with pale to dark brown, stiff or lax, one- to several-celled trichomes; leaves small and inconspicuous, medium-sized, or large and twining, circinate in veneration, closely to widely spaced, or densely caespitose, petiole not articulate at the rhizome, sterile and fertile ones alike, or partly to fully dimorphous; lamina absent to scarcely or normally foliaceous, linear, dichotomously branched, flabelliform, or pinnately arranged; veins commonly free, or in a few species reticulate; sporangia sessile, each with uninterrupted distal annulus, dehiscing longitudinally, marginal (though often appearing to be superficial), not arranged in definite sori, commonly borne in rows on specialized, scarcely- or non-foliaceous fertile segments, with true indusia lacking or consisting of modified, sometimes scalelike, marginal tissue; spores monoletate or trilete, variously sculptured, from 32 to 256 in each sporangium.

An extremely interesting family with cosmopolitan distribution, composed of three to six genera of highly diverse habit and form. Some authors prefer to recognize *Anemia* and *Lygodium* as families; some include *Actinostachys* and *Lophidium* merely as sections of *Schizaea*. Four genera are recognized from Guatemala in this treatment.

- a. Leaves vinelike, twining and scrambling; secondary pinnae arising in pairs from very short stalks on the primary rachis. *Lygodium*.
- a. Leaves erect or suberect; pinnae not arising as above.
 - b. Sterile laminae pinnate to tripinnate; sporangia borne on panicles . . . *Anemia*.
 - b. Sterile laminae simple and grasslike, or several times dichotomous; sporangia borne on terminal, linear segments, these pinnately or (apparently) digitately arranged.
 - c. Sterile laminae simple, grasslike, not lobed or branched; sporangiophores apparently digitate *Actinostachys*.
 - c. Sterile laminae once to several times dichotomous, flabelliform (at least in outline); sporangiophores arranged in pinnate spikes *Schizaea*.

ACTINOSTACHYS Wallich ex Hooker

References: Olof H. Selling, Studies in the recent and fossil species of *Schizaea* . . . Acta Horti Gothob. 16: 1-112. 1944; David W. Bierhorst, Leaf development in *Schizaea* and *Actinostachys*, Amer. J. Bot. 56: 860-870. 1969.

Terrestrial, erect ferns; rhizome horizontal to ascending, thickly invested with one- to several-celled, brownish trichomes; leaves very densely caespitose (or rarely rather widely spaced); petiole triangular, or plane with a narrow, foliaceous wing on either side, glabrous, pale green, or brown toward the base; lamina linear, grasslike and scarcely or not at all foliaceous, glabrous, acute to rounded at apex; sporangiophores terminal, apparently digitate, with sporangia crowded in apparently four rows on the narrowly foliaceous, indusiform segments; spores monolete.

About 15 species, generally distributed in tropical or subtropical regions of both hemispheres, with a majority occurring in the Pacific Islands.

Actinostachys has been treated by some authors as one of three sections (with *Euschizaea* and *Lophidium*) of the genus *Schizaea*. However, as pointed out by Bierhorst (1969), the differences in the arrangement and development of the fertile segments, reinforced by distinctions in embryo and gametophyte, appear to warrant a generic separation at least in *Actinostachys*.

The following is the only species heretofore reported from Guatemala.

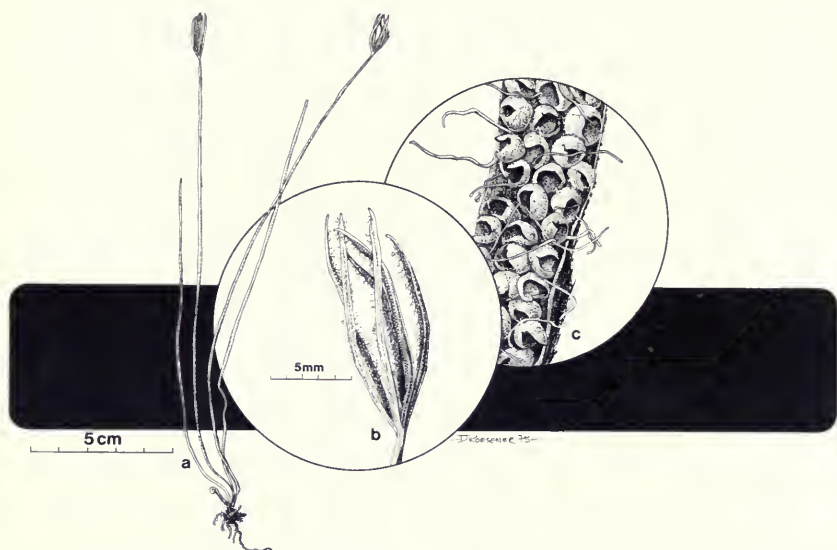


FIG. 6. *Actinostachys germanii*. a, habit, $\times \frac{1}{2}$; b, sporangiophore, $\times 2\frac{1}{2}$; c, sporangiophore segment, $\times 25$.

Actinostachys germanii Fée, Mém. Fam. Foug. 11: 123. 1866.
Schizaea germani Prantl, Unters. Morph. Gefäss. Shiz. II: 132.
 1881.

Known in Guatemala from only one collection, *Steyermark 39864*, lowland jungle, at sea level, Punta Palma, Dept. Izabal, and one from British Honduras, *Peck 936*, mangrove swamp, New Haven. Southern Florida; West Indies; Trinidad; Colombia; Brazil.

Rhizome ascending, provided with stiff, orange to yellowish brown 1- or 2-celled trichomes, which occasionally extend to the lower petiole; leaves several, 8-20 cm. long, erect, caespitose, scarcely foliaceous; petiole generally glabrous, subterete or triangular at the dark brown base, gradually altering above to a flattened, grasslike lamina consisting of a rachis flanked by a pair of narrow wings of tissue, rarely more than 1 mm. broad, subacute at apex; sporangiophores terminal, apparently digitate, segments 3-8, subequal, slender, erect or recurved, 10-15 mm. long, to 0.7 mm. broad, with yellowish brown, filiform trichomes arising around and among the sporangia.

The species of *Actinostachys* are among the least conspicuous of all the ferns and undoubtedly have been overlooked repeatedly in the field. This would explain the apparent disjunct distribution of *A. germanii*; hence it is to be expected this species will be found eventually in other departments of Guatemala, as well as in many other areas of the American Tropics.

ANEMIA Swartz

Reference: J. T. Mickel, A monographic study of the fern genus *Anemia*, subgenus *Coptophyllum*, Iowa State Coll. Sci. 36 (4): 349-482. 1962.

Terrestrial, erect ferns; rhizome horizontal, ascending, or creeping, clothed with orange, reddish, or blackish, filiform to acicular, pluricellular trichomes; leaves polystichous and caespitose, or distichous and closely to widely spaced, fully dimorphous (i.e., either completely fertile or completely sterile), or partly dimorphous, with only the basal pair of pinnae fertile, to 90 cm. long (including the elongate fertile pinnae); petiole and rachis stramineous to dark brown, often darker at base, delicate to wiry to rather stout, terete, rounded beneath, sulcate above, glabrate, or lightly to densely villous with pale to reddish, usually tortuous, trichomes; sterile lamina or portion of lamina oblong to deltoid, pinnate to tripinnate, firm-membranaceous to coriaceous, glabrous, or lightly to densely villous as on the rachis, the trichomes often shorter and fewer-celled or lacking on the adaxial side, veins free or rarely reticulate, commonly oblique and approximate, several to many times dichotomous; fertile pinnae long-stalked, usually elongate and erect, often surpassing the sterile blade, 2- to 3-pinnate, sporangia borne in 2 rows on the ultimate divisions, these either slender and scarcely foliaceous, or narrow-foliaceous and indusiform, but true indusia lacking; spores trilete.

The genus contains 70 to 80 species, occurring in tropical to subtropical regions in both hemispheres, predominantly in the neotropics. The plants are most often found growing on rocks or in rocky situations.

- a. Leaves completely dimorphous, i.e., either wholly fertile or sterile. . . . *A. cicutaria*.
- a. Leaves partly dimorphous, i.e., fertile leaves with only the basal pair of pinnae soriferous.
 - b. Fertile pinnae borne below the base of sterile lamina, i.e., sterile lamina short-stalked; ultimate fertile divisions narrow-foliaceous and indusiform.
 - c. Sterile pinnae 1-4 pairs, merely serrate. *A. speciosa*.
 - c. Sterile pinnae 8 to many pairs, deeply incised or compound.
 - d. Leaves distichous, closely- to widely-spaced; rhizome with dark brown or blackish trichomes. *A. adiantifolia*.
 - d. Leaves polystichous, densely caespitose; rhizomes with orange or reddish trichomes.
 - e. Sterile lamina bipinnate-pinnatifid to tripinnate; rhizome with orange trichomes. *A. guatemalensis*.
 - e. Sterile lamina bipinnate (rarely bipinnate-pinnatifid as to lowermost pair of pinnae); rhizome with reddish brown trichomes. *A. bartlettii*.
 - b. Fertile pinnae borne at base of sterile lamina, i.e., sterile lamina sessile; ultimate fertile divisions slender, not or scarcely foliaceous.
 - f. Veins reticulate; panicle of fertile pinna as long as the stalk or (usually) longer. *A. phyllitidis*.
 - f. Veins free; panicle of fertile pinna shorter than (or rarely equalling) the stalk.

- g. Pinnae mostly deeply incised, the segments commonly narrow and cuneate. *A. hirsuta*.
- g. Pinnae merely crenulate or denticulate, or rarely with a few deep lobes on some lower pinnae.
- h. Petiole of fertile leaf usually greatly exceeding the sterile leaf; lamina gradually tapering to a pinnatifid apex; rhizome horizontal, short-creeping. *A. pastinacaria*.
- h. Petiole of fertile leaf scarcely (if ever) exceeding the sterile leaf; lamina abruptly terminating in an epongate to acuminate or obovate to flabelliform apical segment; rhizome oblique to ascending.
- i. Sterile lamina deltoid or ovate-deltoid, terminating in an acuminate or elongate apical segment; pinnae subacute to acute, mostly short-stalked; leaves petiolate. *A. hirta*.
- i. Sterile lamina obovate-oblong or obovate, terminating in a broadly obovate or flabelliform apical segment; pinnae broadly rounded, sessile; sterile leaves often sessile, forming a rosette. . . . *A. oblongifolia*.

Anemia adiantifolia (L.) Sw. Syn. Fil. 157. 1806. *Osmunda adiantifolia* L. Sp. Pl. 1065. 1753. *O. asplenifolia* Sav. in Lam. Encycl. 4: 652. 1797. *Ornithopteris adiantifolia* (L.) Bernh. Neues J. Bot. 1: 50. 1806. *Anemia asplenifolia* Sw. Syn. Fil. 157. 1806. *Cola* (fide Steyermark, Jalapa).

Rocky, grassy, or partly wooded places, usually on limestone, 0-1,900 m.; Alta Verapaz; Chiquimula; Huehuetenango; Izabal; Jalapa; Petén; Santa Rosa. Peninsular Florida; West Indies; Mexico; British Honduras; Honduras; Costa Rica; also reported from Colombia and Brazil, but specimens not seen.

Rhizome creeping, rather densely clothed with dark brown or blackish, acicular trichomes 2-4 mm. long, these commonly extending to the petiole base; leaves to 65 cm. long (including the erect, fertile pinnae) and 30 cm. broad, distichous, often widely spaced, partly dimorphous, the fertile pinnae borne 0.5-2 cm. below the sterile portion of the lamina, sterile leaf similar in size and shape to the fertile, often a little shorter; petiole of fertile leaf to 45 cm. long, rarely exceeding the sterile leaf, stramineous, darker toward base, or rarely brownish throughout, rather stout, pale to dark villous, glabrate except at base; sterile portion of lamina ovate-deltoid, bipinnate to (commonly) bipinnate-pinnatifid (or tripinnate at base), subcoriaceous, lustrous on both sides, with short, stout, pale trichomes widely scattered on veins and tissue, glabrate above; sterile pinnae anadromous, numerous, ascending, all but upper ones stalked, basal ones to 11 cm. long and 6 cm. broad, the others gradually diminishing in size to a pinnatisect apex; pinnules with ultimate segments commonly obovate or oblanceolate (or rarely linear-obovate or linear-oblong), cuneate, rounded to subtruncate at apex, margins erose-denticulate, slightly cartilaginous; veins free, evident, raised; fertile pinnae to 25 cm. long, panicle commonly longer than its stramineous or light brown stalk, mostly tripinnate, segments narrow-foliaceous and indusiform.



FIG. 7. *Anemia*. a, *A. cicutaria*, habit, $\times \frac{1}{2}$; b, *A. speciosa*, habit, $\times \frac{1}{2}$; c, *A. pastinacaria*, habit, $\times \frac{1}{2}$; d, *A. hirsuta*, portion of sterile lamina, $\times \frac{1}{2}$; e, *A. hirta*, portion of sterile lamina, $\times \frac{1}{2}$; f, *A. oblongifolia*, portion of sterile lamina, $\times \frac{1}{2}$.

Anemia bartlettii Mickel, Iowa State Coll. J. Sci. 36 (4): 420. 1962.

Ravine, mountain pine ridge, 450 m., El Cayo District, British Honduras (type, *Bartlett 11898*). Known only from the type and one other specimen (*Hunt 428*) from type locality.

Rhizome horizontal, densely clothed with reddish brown, filiform trichomes; leaves to 70 cm. long (including the erect, fertile pinnae) and 15 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae borne 1-2 cm. below sterile portion of lamina, sterile leaf similar in size and shape to fertile, often somewhat shorter; petiole of fertile leaf to 45 cm. long, exceeding the sterile leaf, stramineous, atropurpureus toward base, or brownish throughout, rather stout, sparsely to densely invested with orange or reddish, filiform trichomes, glabrate; sterile portion of lamina ovate-deltoid, bipinnate, or rarely bipinnate-pinnatifid as to lowermost pinnae, chartaceous, not lustrous, orange-pilose on both sides; sterile pinnae (at least the lower ones) anadromous, 11-16 pairs, spreading to ascending, those of lower half of lamina short-stalked, to 9 cm. long and 4 cm. broad, oblong, obtuse; pinnules broadly adnate at base, obtuse at apex, crenate or a few on lowermost pinnae deeply pinnatifid, margin not or scarcely cartilaginous; veins free, evident, slightly or not at all raised, a distinct midrib lacking or evident only at base of pinnule; fertile pinnae to 27 cm. long, panicle much longer than its brown stalk, mostly tripinnate, segments narrow-foliaceous and indusiform.

In addition to the differences noted in the key, *Anemia bartlettii* may be further distinguished from *A. guatemalensis* by the color of the stalks of the fertile pinnae, which are darker than the main rachis. In *A. guatemalensis* the stalks of the fertile pinnae are commonly stramineous, or rarely brownish, but in either case they are concolorous with the rachis.

Anemia cicutaria Kunze, Sprengel Syst. Veg. 4: 31. 1827. *A. bipinnata* Moore, Index Fil. 66. 1857 (not Swartz, 1806). *Ornithopteris cicutaria* (Kunze) Underw. Mem. Torrey Bot. Club 12: 15. 1902.

Among rocks, in forests, ca. 120 m.; Petén. Mexico (Yucatan Peninsula and Cozumel Island); Bahama Islands; Cuba.

Rhizome horizontal, short-creeping, with dense tufts of dark- to reddish-brown trichomes; leaves closely grouped, obscurely distichous, fully dimorphous (i.e., either completely fertile or completely sterile), the fertile much longer than the sterile, petioles delicate, stramineous, or occasionally brown at base; sterile leaf to 15 cm. long and 5 cm. broad, petiole to 8 cm. long, mostly glabrate, lamina ovate to deltoid-ovate, bipinnate to bipinnate-pinnatifid, firm-herbaceous, pilose (often sparsely so) on both sides; pinnae 3-7 pairs, anadromous, subequilateral, spreading to ascending, short-stalked, deltoid-ovate, obtuse to subacute, margins slightly cartilaginous; pinnules mostly sessile, oblong to obovate to rhomboid, cuneate at base, entire, or broadly dentate at apex; veins evident to somewhat obscure, slightly raised; fertile leaf erect, to 25 cm. long, petiole to 15 cm. long, commonly much

longer than the fertile panicle, mostly tripinnate, the segments narrow-foliaceous and indusiform.

This is the only species of *Anemia* in Central America with leaves fully dimorphous. Thus far, it has been reported in Guatemala only from Petén. However, the plants are relatively small and quite inconspicuous, and should eventually be found in other areas.

Anemia guatemalensis Maxon, North Amer. Fl. 16: 46. 1909.
Hemianemia guatemalensis (Maxon) Reed, Bol. Soc. Brot. 21 (2): 161. 1947.

Grassy banks, rocky hillsides, mostly in pine-oak forests, 1,000-2,000 m.; Baja Verapaz; Chimaltenango; Escuintla; Guatemala; Huehuetenango; Jalapa; El Quiché; Santa Rosa (type from Cerro Gordo, *Heyde & Lux 4095*). Honduras; El Salvador.

Rhizome horizontal, densely clothed with orange trichomes; leaves to 65 cm. long (including the erect, fertile pinnae) and 25 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae borne 1-3 cm. below sterile portion of lamina, sterile leaf similar in shape to fertile, commonly much shorter; petiole of fertile leaf to 40 cm. long, not or slightly exceeding the sterile leaf, commonly stramineous throughout, rather stout, sparsely to closely invested with pale to orange, filiform trichomes, glabrate; sterile portion of lamina ovate-deltoid, bipinnate-pinnatifid to tripinnate, subcoriaceous, not lustrous, pale- or orange-pilose beneath, sparsely so or glabrous above; sterile pinnae 8-15 pairs, catadromous, or a few lower ones anadromous, spreading to ascending, those of lower half of lamina short-stalked, to 12 cm. long and 7 cm. broad, ovate to lanceolate, subacute; pinnules mostly narrow-adnate at base, obtuse to acute at apex, pinnatifid to pinnatisect, or those of lower pinnae fully pinnate, margin not or scarcely cartilaginous; veins free, evident, slightly or not at all raised, a distinct midrib lacking or evident only at base of segment; fertile pinnae to 21 cm. long, panicle much longer than its usually stramineous stalk, mostly tripinnate, segments narrow-foliaceous and indusiform.

Anemia hirsuta (L.) Sw. Syn. Fil. 155. 1806. *Osmunda hirsuta* L. Sp. Pl. 1064. 1753.

In rocky or grassy places, shaded or open slopes or in forests, 200-2,200 m.; Guatemala; Huehuetenango; Jalapa; Jutiapa; Santa Rosa; Sololá; Zacapa. Greater Antilles; Trinidad and Tobago; Mexico to Brazil and Bolivia.

Rhizome horizontal, short-creeping, densely clothed with orange, filiform trichomes; leaves to 35 cm. long (including the erect, fertile pinnae) and 5 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae and lowermost sterile pinnae arising from the same position on the axis, sterile leaf similar in shape to the fertile, but with much shorter petiole; petiole of fertile leaf to 18 cm. long, commonly much exceeding the sterile leaf, stramineous, often atropurpureous at base, wiry, sparsely orange-villous, glabrate, sterile portion of lamina oblong-lanceolate to ovate-oblong, gradually tapering to a pinnatifid apex, pinnate-pinnatifid to bipin-

nate, firm-herbaceous, dull, or somewhat lustrous above, villous beneath, sparsely villous or glabrate above; sterile pinnae 7-12 pairs, spreading or slightly ascending, those of lower half of blade short-stalked, to 2.5 cm. long and 0.8 cm. broad, oblong to ovate-oblong, obtuse to subacute, commonly inequilateral at base, truncate above and cuneate below, obliquely and deeply incised into linear or narrowly cuneate segments, these irregularly toothed, margins not cartilaginous, a distinct midrib lacking or evident only at pinna base; veins free, commonly obscure beneath, raised and distinct above; fertile pinnae to 18 cm. long, panicle much shorter than (or rarely equalling) the stramineous stalk, mostly tripinnate, ultimate divisions slender and scarcely foliaceous.

Beyond the characters used in the key, there is little to distinguish *Anemia hirsuta* from *A. pastinacaria*, both of which share the same general distribution, habitat, and sometimes even the same herbarium sheet. Mickel (pers. comm.) reports that he has found *A. hirsuta*, *A. pastinacaria*, and *A. jaliscana* growing together in Oaxaca, and all apparently hybridizing readily. He also advises that *A. hirsuta* crosses with *A. tomentosa*, *A. karwinskyana*, and *A. phyllitidis* in Mexico.

***Anemia hirta* (L.) Sw. Syn. Fil. 155. 1806. *Osmunda hirta* L. Sp. Pl. 1064. 1753.**

In forests, about 400 m.; Petén. British Honduras; Honduras; West Indies; Brazil.

Rhizome ascending, clothed at apex with deep orange or reddish, filiform trichomes; leaves to 32 cm. long (including the erect, fertile pinnae) and 10 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae and lowermost sterile pinnae arising from same position on the axis, sterile leaf similar in shape to the fertile, but with shorter petiole; petiole of fertile leaf to 20 cm. long, scarcely (if ever) exceeding the sterile leaf, stramineous, wiry to rather stout, rather densely rusty-villous; sterile portion of lamina deltoid or ovate-deltoid, terminating in an acuminate or elongate apical segment, pinnate, firm-membranaceous, dull to slightly lustrous, sparsely to densely villous, rachis rusty-villous like the petiole; sterile pinnae 7-12 pairs, spreading to slightly ascending, basal pair often deflexed, mostly short-stalked, to 5.5 cm. long and 1.5 cm. broad, obliquely lanceolate, acute or subacute, strongly inequilateral at base, truncate or rounded above and cuneate below, crenulate, margin slightly or not at all thickened, midrib distinct nearly to apex; veins free, distinct, raised on adaxial side; fertile pinnae to 18 cm. long, panicle shorter than (or rarely equalling) the stramineous stalk, mostly tripinnate, ultimate divisions slender and scarcely foliaceous.

It is difficult to account for the curious disjunction in the distribution of this species. Among all collections examined, the only South American representation was southeastern Brazil. *Anemia hirta* is not a particularly inconspicuous species and it seems that it should have been found in at least a few localities between Brazil and the

Lesser Antilles. However, Mickel noted in his monograph that *A. bartlettii* has a similar disjunction with its nearest relatives.

Anemia oblongifolia (Cav.) Sw. Syn. Fil. 156. 1806. *Osmunda oblongifolia* Cav. Icon. Descr. Pl. 6: 69. 1801. *O. humilis* Cav. l.c. *Anemia humilis* (Cav.) Sw. Syn. Fil. 156. 1806. *A. pilosa* Mart. & Gal. Nouv. Mém. Acad. Roy. Sci. Bruxelles 15 (5): 19. 1842. *A. seemannii* Hook. London J. Bot. 7: 564. 1848. *A. presliana* Prantl, Unters. Morph. Gefäss. Schiz. II: 104. 1881.

In forests, on rocks or rocky banks, 200-650 m.; Chiquimula; Zacapa. Mexico to Panama; Venezuela to Brazil and Bolivia.

Rhizome oblique or ascending; clothed with orange or reddish, filiform trichomes; leaves to 30 cm. long (including the erect, fertile pinnae) and 3.5 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae and lowermost sterile ones arising from the same position on the axis, sterile leaf similar in size and shape to the fertile; petiole of fertile leaf 1-6 cm. long, shorter than the sterile leaves, stramineous, or often light brown and strongly arcuate at base, rather stout, sparsely villous, glabrate; sterile portion of lamina obovate-oblong or obovate, terminating in a broadly obovate to flabelliform apical segment, pinnate, coriaceous or subcoriaceous, slightly lustrous, especially above, pale- or orange-pilose on both sides, sparsely so on rachis; sterile pinnae 2-9 pairs, spreading to slightly ascending, contiguous or subimbricate, sessile, to 1.8 cm. long and 0.7 cm. broad, oblong, broadly rounded at apex, strongly inequilateral at base, truncate or rounded above and cuneate below, crenulate, margin somewhat thickened, a distinct midrib lacking; veins free, rather evident, raised on adaxial side; fertile pinnae to 18 cm. long, panicle much shorter than the stramineous stalk, mostly tripinnate, ultimate divisions slender and only slightly foliaceous, becoming less so at maturity.

Anemia oblongifolia is one of the most distinctive of the Central American species. The coarse, broadly rounded pinnae are often nearly as broad as long; the slender, fertile pinnae extend far above their own sterile blades; and the sterile leaves are so short and so densely caespitose that they sometimes appear rosette-like.

Anemia pastinacaria Moritz, in Prantl Unters. Morph. Gefäss. Schiz. II: 110. 1881. *A. longistipes* (Liebm.) C. Chr. Index Fil. 53. 1905.

In rocky or grassy places, shaded or open slopes or in forests. 750-1,650 m.; Alta Verapaz; Baja Verapaz; Chimaltenango; Huehuetenango; Izabal; Jalapa; Jutiapa; Petén; Santa Rosa; Zacapa. Cuba; Trinidad; Mexico to Panama; Venezuela to Brazil and Bolivia.

Rhizome horizontal, short-creeping, densely clothed with orange, filiform trichomes; leaves to 45 cm. long (including the erect, fertile pinnae) and 7 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae and lowermost ster-

ile ones arising from same position on the axis, sterile leaf similar in shape to the fertile, but with much shorter petiole; petiole of fertile leaf to 22 cm. long, usually greatly exceeding the sterile leaf, commonly stramineous, often atropurpureus at base, or brownish throughout, wiry to rather stout, glabrate; sterile portion of lamina ovate-deltoid to ovate-oblong, gradually tapering to a pinnatifid apex, only rarely with a distinct apical segment, pinnate, firm-membranaceous to subcoriaceous, dull to somewhat lustrous, pilose beneath, sparsely so or glabrate above, rachis sparsely orange-villous; sterile pinnae 5-10 pairs, spreading or slightly ascending, subsessile, to 3.5 (5) cm. long and 1.5 (2) cm. broad, obliquely oblong, obtuse to acute, inequilateral at base, truncate or subtruncate above, cuneate below, denticulate or crenate, or rarely with several deep lobes on lower pinnae, margin slightly or not at all thickened, a midrib lacking or sometimes evident half the length of the pinna; veins free, distinct and raised on adaxial side; fertile pinnae to 23 cm. long, panicle much shorter than (or rarely equalling) the brownish or stramineous stalk, mostly tripinnate, ultimate divisions slender and scarcely (or not at all) foliaceous.

Some rather coarse specimens from Guatemala (*Standley 80916*), Chimaltenango; *Standley 82373*, Huehuetenango) and several from Honduras have been determined in herbaria as *A. phyllitidis*, due to their apparent reticulate venation and their relatively large and coarse pinnae (to 5 cm. long and 2 cm. broad). However, this anastomosing of veins is infrequent and generally rather casual, and in no other features do these specimens truly resemble *A. phyllitidis*. The pinnae are strongly inequilateral, with a midrib extending halfway or less to a subacute apex, and some lower pinnae are deeply lobed. The fertile panicles are much shorter than their stalks, and the sterile blades gradually taper to a pinnatifid apex. The position of these particular specimens appears to lie somewhere between *A. hirsuta* and *A. pastinacaria*. It is possible they are hybrids between one of these and *A. phyllitidis*. They are provisionally determined here as *A. pastinacaria*. See further discussion of this species relationship under *A. hirsuta*.

Anemia phyllitidis (L.) Sw. Syn. Fil. 155. 1806. *Osmunda phyllitidis* L. Sp. Pl. 1064. 1753.

Moist, often rocky, slopes and banks of ravines, in thickets and edges of forests, 900-2,400 m.; Alta Verapaz; Chimaltenango; Chiquimula; El Progreso; Escuintla; Guatemala; Huehuetenango; Jalapa; Santa Rosa; Sololá; Zacapa. Greater Antilles (rare); Trinidad; Mexico to Panama; Colombia and Venezuela to Argentina.

Rhizome oblique to ascending, rather densely clothed with long (to 7 mm.), filiform, orange to reddish brown trichomes; leaves to 90 cm. long (including the erect, fertile pinnae) and 25 cm. broad, polystichous, caespitose, partly dimorphous, the fertile pinnae and lowermost sterile ones arising from the same position on the axis,

paripinnate or imparipinnate, the terminal segment (if present) subequal to next pinna below, sterile leaf similar in shape to the fertile, but often shorter; petiole of fertile leaf to 70 cm. long, frequently exceeding the sterile leaf (but more often not), stramineous, or dark brown at base, stout, rather densely villous, often glabrate, especially above; sterile portion of lamina ovate to deltoid, once-pinnate (or rarely the lowermost pinnae lobed near the base), commonly subcoriaceous, dull to slightly lustrous, rigidly and sparsely pilose, glabrate; sterile pinnae 3-7 pairs, ascending, or the lowermost spreading, sessile or short-stalked, to 14 cm. long and 3 cm. broad, ovate to lanceolate, often subfalcate, acute to acuminate, subequilateral at base and rounded to truncate (or rarely some upper ones inequilateral), crenulate to dentate, margin slightly cartilaginous, a distinct midrib extending nearly or fully to apex; veins copiously anastomosing, rather obscure, or somewhat distinct and raised above; fertile pinnae to 40 cm. long, panicle as long as the stramineous to reddish brown stalk or (usually) longer, commonly tripinnate, ultimate divisions slender and scarcely or not at all foliaceous.

Anemia speciosa Presl, Abh. Böhm. Ges. Wiss. V. 4: 349. 1845. *A. mexicana* Kl. var. *paucifolia* Hook., 2nd Cent. Ferns, t. 65, 1861. *Ornithopteris speciosa* (Presl) Reed, Bol. Soc. Brot. 21 (2): 153. 1947.

On bluffs and at forest edges, mostly on limestone, 0-1,350 m.; Alta Verapaz; Izabal; Petén. Cuba; Mexico; British Honduras.

Rhizome creeping, closely invested with brown to blackish, acicular trichomes; leaves to 50 cm. long (including the erect, fertile pinnae) and 15 cm. broad, distichous, crowded, partly dimorphous, the fertile pinnae borne 0.6-2.8 cm. below the sterile portion of the lamina, sterile leaf similar in size and shape to the fertile; petiole of fertile leaf to 30 cm. long, shorter than the sterile leaf, stramineous to light brown, darker at base, wiry to rather stout, sparsely pilose, glabrate; sterile portion of lamina deltoid, ovate or oblong-lanceolate, once-pinnate (or rarely the lowermost pinnae lobed at base), coriaceous to subcoriaceous, dull, or somewhat lustrous above, glabrous; sterile pinnae 1-4 pairs, spreading or more often ascending, stalked, to 10 cm. long and 3.5 cm. broad (the apical segment commonly larger), ovate to oblong-lanceolate, subacute to acuminate, subequilateral at base and rounded to subcordate, margin serrulate or serrate, cartilaginous, a distinct midrib extending nearly or fully to apex; veins free, impressed above, somewhat raised and rather distinct beneath; fertile pinnae to 12 cm. long, panicle longer than its stramineous or light brown stalk, 2- to 3-pinnate, segments narrow-foliaceous and indusiform.

Although superficially resembling *Anemia phyllitidis* in its undivided pinnae and the apical segment of the lamina similar to the pinnae below, *A. speciosa* is easily distinguished from the former by its free venation and its fertile pinnae borne beneath the sterile portion of the lamina. *A. phyllitidis* has reticulate venation and the fertile pinnae and lowermost sterile ones arising together on the axis.

LYGODIUM Swartz

References: A. H. G. Alston & R. E. Holttum, Notes on the taxonomy and nomenclature in the genus *Lygodium* (Schizaeaceae), *Reinwardtia* 5: 11-22. 1959.

Vinelike plants with relatively short petioles but indefinitely long, flexuous, scandent or trailing rachises; rhizome subterranean, branched and creeping, rather densely clothed with stout, dark trichomes; leaves closely to rather widely spaced, obscurely distichous, but ostensibly in a single row; rachis bearing alternate pinnae, these with a minute stalk terminated by an arrested bud and flanked by a pair of secondary pinnae; pinna stalk commonly a few millimeters long or appearing merely as a rounded protuberance on the main rachis; secondary pinnae palmate, pinnately branched, or with lateral pinnules lacking, the pinna stalk thus bearing a dichotomously lobed or subpalmate lamina; veins commonly free (reticulate in *L. heterodoxum*); fertile pinnae similar in size and shape to the sterile, or (in a few species) greatly constricted; sporangia apparently dorsal, in a single row on each side of the midvein of contracted segments which are pinnately arranged along the margins of the pinnules, the tissue serving as an indusium; spores trilete, commonly with perine.

A pantropic genus, containing about 35 species. It is a natural group, and quite distinctive due to its vinelike habit. The following three species occur in Guatemala.

- a. Veins reticulate *L. heterodoxum*.
- a. Veins free.
 - b. Tertiary pinnules (at least the fertile ones) gradually diminishing in size toward pinna apex, often hastate, not articulate, only slightly swollen (if at all) at junction with their stalks *L. venustum*.
 - b. Tertiary pinnules subequal, not hastate, nodose-articulate at junction with their stalks *L. volubile*.

***Lygodium heterodoxum* Kunze, Farrnkr. 2: 32. 1849.**

Scandent or trailing on trees, shrubs and herbs, in forests and damp thickets, 0-1,000 m.; Alta Verapaz; Huehuetenango; Izabal; Petén. Southern Mexico to Costa Rica; reported from Venezuela, but no specimens seen.

Rhizome short-creeping, clothed with stout, pluricellular, lustrous, blackish trichomes; leaves several meters long; petiole and rachis stout, to 3 mm. in diameter, terete, glabrous (rarely puberulent), stramineous, or the petiole brownish at base; pinna stalks scarcely evident, 1-3 mm. long, the terminal bud inconspicuous, mostly covered with pale to whitish, few-celled trichomes; secondary pinnae to 40 cm. long and 30 cm. broad, pinnately branched, or often dichotomously or palmately cleft, the pinnules or segments subequal in size and shape; tertiary pinnules 1-4 pairs, to 25 cm. long, simple and lanceolate to oblong (rarely subhastate) or dichotomously to subpalmately cleft into elongate segments, their stalks mostly narrow-alate, margins broadly and obscurely serrulate; costules continuous, not nodose-articulate at

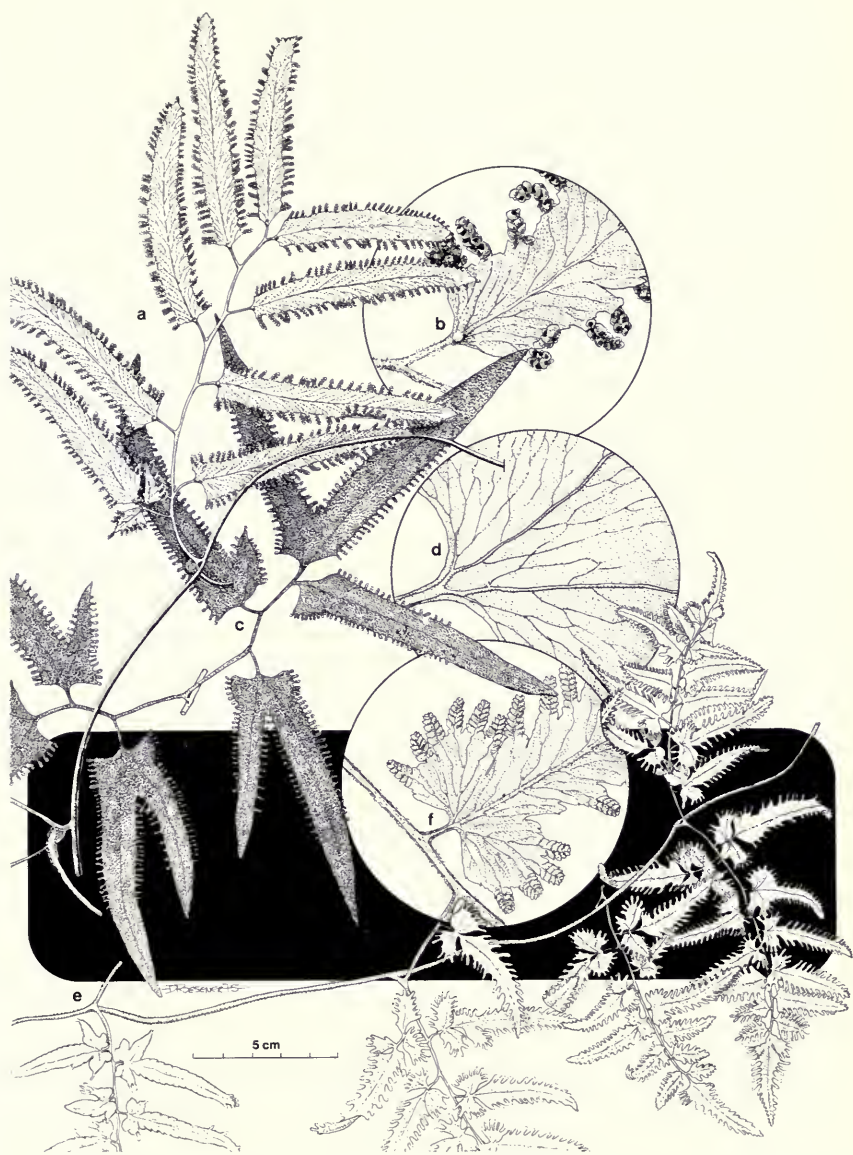


FIG. 8. *Lygodium*. a-b, *L. volubile*: a, habit, $\times \frac{1}{2}$; b, base of tertiary pinnule, $\times 2$; c-d, *L. heterodoxum*: c, habit, $\times \frac{1}{2}$; d, base of tertiary pinnule, $\times 2\frac{1}{2}$; e-f, *L. venustum*: e, habit, $\times \frac{1}{2}$; f, base of tertiary pinnule, $\times 2$.

segment base; leaf tissue firm-membranaceous, rather lustrous on both surfaces, glabrous; midribs and veins glabrous or nearly so; veins oblique, raised, reticulate, forming 3-5 ranks of areoles between midrib and margin.

Known in southern Mexico as "bejuco de alambre," "palmillo," and "yerba de culebra." The petiole and lower parts of the rachis are used in basket making in the Usumacinta River region of Huehuetenango, and are considered there to be better than "mimbre," the vining stem of *Monstera* or *Philodendron* sold in the local markets.

Lygodium venustum Sw. J. Bot. (Schrader) 1801 (2): 303. 1803; Alston & Holttum, Reinwardtia 5: 15. 1959. *L. mexicanum* Presl, Rel. Haenk. 1: 72. 1825. *L. commutatum* Presl, Abh. Böhm. Ges. Wiss V. 4: 370. 1845 (type from Hacienda de Santa Luca, Guatemala?, *Friedrichsthal*). *Alambrillo* (Retalhuleu).

Scandent or trailing, in forests and thickets, often on rocky bluffs, 0-1,000 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Escuintla; Izabal; Jutiapa; Petén; El Progreso; Retalhuleu; San Marcos; Santa Rosa; Zacapa. West Indies; Mexico and Central America southward to Brazil and Bolivia.

Rhizome creeping; rhizome and petiole base densely clothed with stout, pluricellular, lustrous, blackish trichomes; leaves to several meters long; petiole and rachis stout, terete, to 2.5 mm. in diameter, petiole to 30 cm. long, glabrous or nearly so, light- or gray-brown, darker at base, rachis stramineous or light brown, sparsely to densely puberulent; pinna stalks 5-10 mm. long, terminal bud inconspicuous to scarcely evident, covered with pale to rusty, few-celled trichomes; secondary pinnae pinnate to bipinnate, to 25 cm. long and 20 cm. broad, the pinnules gradually diminishing in size toward pinna apex; tertiary pinnules (3) 5-8 pairs, to 8 (10) cm. long, lanceolate with a broadly cuneate base or elongate deltoid-ovate with a cordate base, bearing 1-3 distinct pairs of subsessile, auriculiform, deltoid-ovate to flabellate segments, or (more commonly) with a pair of enlarged acute to obtuse basal lobes, thus appearing subhastate or halberd-shaped; midrib of tertiary pinnules pilose (usually densely so), not articulate, though sometimes slightly swollen at the junction with the stalk, narrow-alate, the wings often continuing down along the axis of the next order; leaf tissue firm-membranaceous or papyraceous, slightly lustrous, especially above, glabrous; midribs and veins sparsely to densely pilose; veins oblique, raised, free, once to several times forked.

Called "yerba buena" in Southern Mexico and "crespillo" in southern Mexico, El Salvador, and Nicaragua.

This species has been often confused with, and frequently determined, *Lygodium polymorphum* HBK. However, the latter name is a synonym of the Asiatic *L. flexuosum* (L.) Sw., a species with which *L. venustum* is closely allied, but from which it is considered distinct.

Lygodium mexicanum has been treated as a distinct species, on the basis that the tertiary segments are continuous with their stalks, the basal veins are alternate, the pubescence is less dense, and the tissue more lustrous. It has been claimed that the segments of *L. venustum* are nodose-articulate on their stalks and that the basal veins are opposite or subopposite. However, these characters are not consistent. Degree of luster and amount of pubescence varies. The basal veins of segments can be predominantly opposite in some specimens, alternate in others, or both conditions may occur on adjacent segments on the same specimen. Furthermore, the tertiary segments are never truly articulate on their stalks. Occasionally there may be a slight swelling at the point from which the basal veins arise, but this condition varies widely on individual specimens.

***Lygodium volubile* Sw. J. Bot. (Schrader) 1801 (2): 304. 1803.**

Scandent, in forests, 0-200 m.; Izabal. British Honduras; Jamaica; Cuba; Trinidad; South America.

Rhizome short-creeping, covered with stout, pluricellular, lustrous, deep brown to blackish trichomes; leaves to several meters long; petiole and rachis stout, terete, to 2.5 mm. in diameter, glabrous or slightly puberulent, stramineous to light brown or grayish, darker at base; pinna stalks 1-2 mm. long, terminal bud scarcely evident, covered with pale to rusty, few-celled trichomes; secondary pinnae pinnate, to 20 cm. long and often as broad, the pinnules subequal in size and shape; tertiary pinnules 2-5 pairs, to 15 cm. long and 2.5 cm. broad, oblong-lanceolate, acute or acuminate at apex, base broadly cuneate, truncate or subcordate (or very rarely auriculate-hastate), nodose-articulate at junction with the stalk, margins crenulate-serate; stalks of tertiary pinnules narrow-alate, the wings often continuing down along the axis of the next order; leaf tissue firm-membranaceous, slightly lustrous, glabrous to short-pilose; midrib and veins glabrous to pilose; veins oblique, raised, free, commonly once or twice forked.

EXCLUDED SPECIES

LYGODIUM RADIATUM Prantl, Unters. Morph. Gefass. Schiz. 2: 66. 1881. *L. digitatum* Eaton, Mem. Amer. Acad. Arts 2. 8: 217. 1860.

L. digitatum was reported by Hemsley (Biol. Cent. Am. Bot. 3: 694. 1886) to be in Guatemala, citing a Godman & Salvin collection from Izabal. I have not seen this specimen, but it is likely a misidentification, for *L. digitatum* (= *L. radiatum*) has not been reported with certainty north of Costa Rica.



FIG. 9. *Schizaea elegans*. a, habit, $\times \frac{1}{2}$; b, sporangiophore, $\times 4$; c, sporangiophore segment, abaxial side, $\times 16$; d, sporangiophore segment, adaxial side, $\times 16$.

SCHIZAEA J. E. Smith

References: Olof H. Selling, Studies in the recent and fossil species of *Schizaea* . . . Acta Horti Gothob. 16: 1-112, 1944; David W. Bierhorst, Leaf development in *Schizaea* and *Actinostachys*, Amer. J. Bot. 56: 860-870. 1969.

Terrestrial, mostly erect ferns; rhizome minute to stout, horizontal or ascending, sometimes short-creeping, thickly invested with pale to brown, one- to several-celled trichomes; leaves commonly distichous, closely spaced or densely caespitose, simple and linear, grasslike, or once to several times dichotomous with ultimate divisions scarcely foliaceous, or, in ours, flabelliform (at least in general outline) and foliaceous, with the divisions linear-oblong to obovate; petiole generally glabrous, much longer than the lamina, commonly rounded to obtusely angled abaxially, sulcate adaxially; sporangiophores in terminal clusters, pinnatifid, with sporangia borne in 2 crowded rows on the narrowly-foliaceous, indusiform segments; spores monolete.

About 30 species occurring generally in tropical or subtropical regions, in both hemispheres, but most prevalent in South America and the Pacific Islands. Only one species has been reported from Guatemala.

Schizaea elegans (Vahl) Sw. J. Bot. (Schrader) 1800 (2): 103. 1801. *Acrostichum elegans* Vahl, Symb. Bot. 2: 104. 1791. *Lophidium elegans* (Vahl) Presl, Suppl. Tent. Pterid. 77. 1845.

In dense, wet forests, on wooded slopes and ridges, 0-500 m.; Alta Verapaz; Huehuetenango; Izabal; Petén. Southern Mexico to Panama; Colombia to Trinidad and southward to Brazil and Bolivia.

Rhizome horizontal or ascending, densely covered with pale, stramineous or light brown, 1- to several-celled trichomes which often extend onto the lower petiole; leaves erect, caespitose, 20-70 cm. long; petiole stout, to 50 cm. long and 2.5 cm. thick, rounded to obtusely angled on abaxial side, rather broadly sulcate on adaxial side, mostly glabrous, stramineous, darker brown toward the base; lamina to 20 cm. long, subcoriaceous, glabrous, slightly lustrous, flabelliform (at least in general outline), once to several times dichotomously forked or cleft, the divisions linear-oblong, oblanceolate or obovate, with margins entire and plane or slightly revolute, the apices sharply lacerate; costae once to several times forked within the ultimate divisions; sporangiophores pinnately branched at the tips of the lacerations, with sporangia borne in 2 crowded rows on the recurved, villous, narrowly foliaceous, indusiform segments.

GLEICHENIACEAE

References: L. M. Underwood, A preliminary review of the North American Gleicheniaceae, Bull. Torrey Bot. Club 34: 243-262. 1907;

W. R. Maxon, *Gleicheniaceae*, in *North Amer. Fl.* 16: 53-63. 1909; T. Nakai, A new classification of *Gleicheniales*, *Bull. Natl. Sci. Mus. Tokyo* 29: 1-71. 1950; R. E. Holttum, On the taxonomic subdivision of *Gleicheniaceae*. . . *Reinwardtia* 4: 257-280. 1957.

Coarse, terrestrial plants, leaves scandent or trailing, often widely spreading and forming dense thickets, frequently xerophilous; rhizome long-creeping on or just beneath the surface of the ground, frequently branching, variously provided with scales or trichomes; leaves commonly large (often to several meters long), circinate in veneration, widely spaced to (rarely) subfasciculate, petiole not articulate at the rhizome, sterile and fertile leaves alike, once or several times pseudodichotomously branched; petiole bearing a pair of opposite pinnae, with an arrested bud at its apex, or continuing as the rachis which produces one or two more opposite pairs of pinnae; pinnae bipinnate, or once to several times pseudodichotomously branched, with each succeeding axis bearing an arrested apex; indument consisting of scales or of simple, branched or stellate trichomes; veins free, simple or once to several times forked; sori abaxial on the veins, circular in shape, exindusiate, each composed of 2 to many sporangia, situated on a barely elevated receptacle; sporangia sessile or subsessile, pyriform, each with an essentially complete, transverse, usually medial annulus, dehiscing longitudinally; spores 120 to ca. 800 in each sporangium, monolete or trilete, generally smooth and (in ours) lacking significant ornamentation.

The pseudodichotomous branching of leaves and the usually pectinate penultimate segments make this one of the most distinctive of fern families. These frequently xerophilous plants are often weedy, their large, spreading leaves forming dense tangles or thickets along banks of ravines or over low shrubs. Approximately 120 species have been recognized by various authors in as many as eight genera, these primarily based upon differences in type of indument, shape of spores, and degree of branching. The following treatment is based generally on the classification of Holttum (1957). Two genera are recognized in Guatemala.

- a. Leaves and rhizomes with trichomes only, scales lacking; veins with 2 or more forks; sori commonly with 6 or more sporangia *Dicranopteris*.
- a. Leaves and rhizomes with scales and trichomes; veins once-forked; sori with 2 to 5 sporangia *Gleichenia*.

DICRANOPTERIS Bernhardt

Reference: R. C. Ching, On the genus *Gleichenia* Smith, *Sunyatsenia* 5: 269-289. 1940.

Rhizome provided with rigid, or somewhat lax, pluricellular trichomes; leaves rather widely spaced; petiole at first erect, stout, rigid, of indeterminate growth, bearing one to several pairs of opposite pinnae which again branch one or more times in opposite pairs, or which branch alternately and quite unequally; only the penultimate segments are pectinate, other axes are naked; a dense tuft of trichomes and a pair of reduced, stipule-like appendages borne within each fork; penultimate

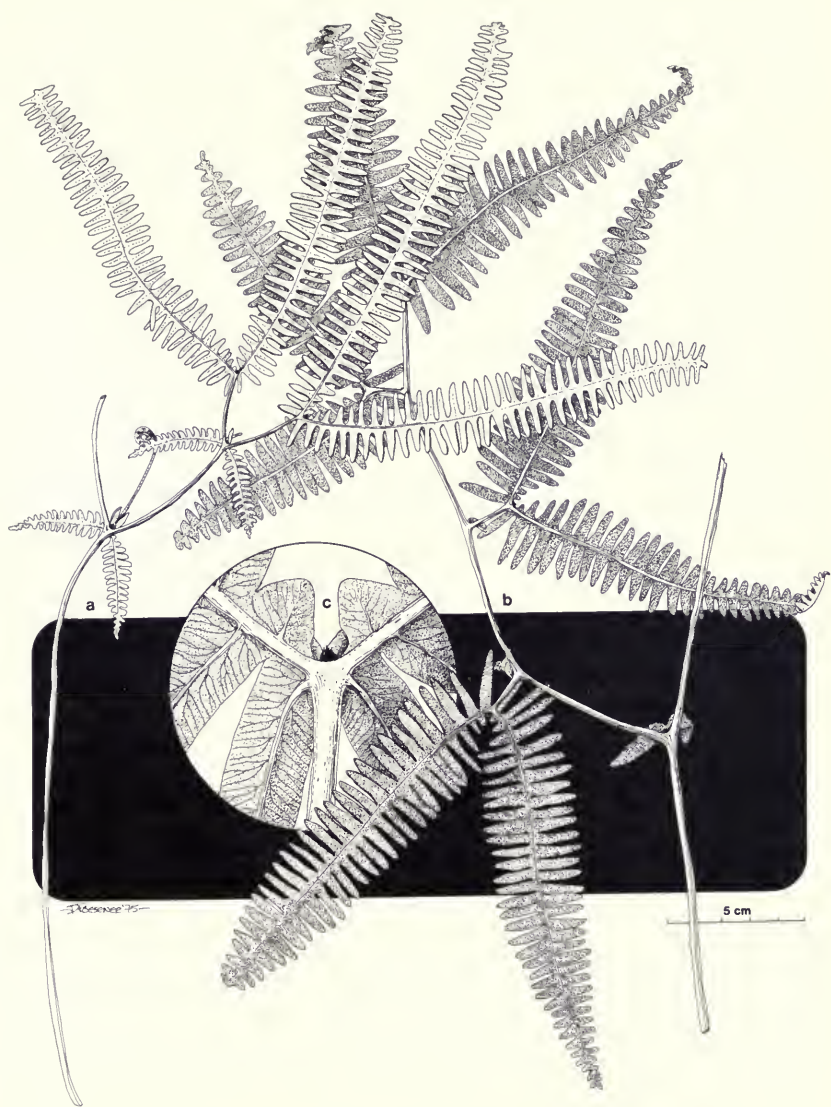


FIG. 10. *Dicranopteris*. a, *D. flexuosa*, habit, $\times \frac{1}{2}$; b-c, *D. pectinata*: b, habit, $\times \frac{1}{2}$; c, base of fork, showing tuft of trichomes and pair of appendages borne within, $\times 3\frac{1}{2}$.

segments borne in pectinate, subequal, usually ascending pairs; veins several times forked; sori exindusiate, each composed of 6 to many sporangia; spores monolete or (more commonly) trilete, smooth-surfaced, commonly lacking significant ornamentation.

An essentially pantropical genus of eight or 10 species, growing most frequently in dry, open locations, often forming dense mats or thickets. It is readily distinguished, within the family, by its lack of scales, the indument consisting solely of trichomes.

- a. Penultimate (and other) axes branching in opposite pairs; accessory, mostly reduced, leafy segments usually borne in pairs at the base of each fork (these in addition to stipule-like segments borne *within* the forks) *D. flexuosa*.
- a. Penultimate axes borne alternately along the axis of the next order below; accessory, mostly reduced, leafy segments not borne in pairs at the base of each fork (not to be confused with the stipule-like segments borne *within* the forks)
D. pectinata.

Dicranopteris flexuosa (Schrad.) Underw. Bull. Torrey Bot. Club 34: 254. 1907. *Mertensia flexuosa* Schrad. Gött. gel Anz. 863. 1824. *Gleichenia flexuosa* (Schrad.) Mett. Ann. Lugd. Bat. 1: 50. 1863.

Leaves scandent or trailing, on dry, open slopes and ridges, or in moist, open woods, 1,400-2,500 m. Alta Verapaz; Quezaltenango. West Indies; Southern Mexico to Panama, southward to Brazil, Bolivia and Paraguay. (Some isolated collections in the United States from coastal Alabama.)

Rhizome protostelic, long-creeping, provided with rigid, reddish brown trichomes, these falling away cleanly, leaving the surface smooth or only slightly scabrous; petiole terete, stramineous to light brown, smooth and rather lustrous, glabrous except at the very base; pinnae one to several opposite pairs, these repeatedly pseudodichotomous, with all subsequent branches in opposite pairs; a tuft of reddish trichomes and a pair of reduced, subentire to pinnatisect, stipule-like appendages borne within each fork; a pair of reduced, accessory, pectinate segments commonly produced at the base of each fork, the other axes otherwise naked; penultimate segments sessile, branched in divergent to strongly ascending, subequal pairs, to 30 cm. long and 6 cm. broad, deeply pinnatisect, lanceolate to oblanceolate, coriaceous, glabrous, glaucous beneath; ultimate segments mostly linear, retuse, slightly dilated toward the base, margins strongly revolute, often folded back and nearly touching each other beneath the segment; veins 2- to 4-forked, approximate; sori inframedial between midrib and margin; sporangia yellow- to red-brown, commonly 6-12 per sorus; spores trilete.

Dicranopteris pectinata (Willd.) Underw. Bull. Torrey Bot. Club 34: 260. 1907. *Mertensia pectinata* Willd. Kongl. Vetensk. Acad. Nya Handl. II. 25: 168. 1804. *Gleichenia pectinata* (Willd.) Presl, Rel. Haenk. 1: 71. 1825. *Gleichenella pectinata* (Willd.) Ching, Sunyatsenia 5: 276. 1940.

Leaves clambering, often forming dense thickets, on dry, open, sometimes rocky slopes or moist, shaded river banks, and at edges of forests, 0-2,300 m. Alta Verapaz; Huehuetenango; Izabal; Quezaltenango; Zacapa. West Indies; Mexico to Panama, Colombia to Trinidad, southward to Bolivia and Brazil.

Rhizome solenostelic, long-creeping, strongly and conspicuously scabrous from the persistent bases of slender, pluricellular reddish brown trichomes; petiole terete, stramineous to light brown, smooth and glabrous except near the base; pinnae one to several opposite pairs, each of these bearing several alternate branches which are again alternately branched or which terminate in a pair of penultimate segments; a tuft of reddish trichomes and a pair of reduced, entire to pinnatisect stipule-like appendages borne within each fork, other axes completely naked and without reduced, accessory segments at the base of each fork; penultimate segments sessile, branched in divergent to strongly ascending, subequal pairs, to 25 cm. long and 5.5 cm. broad, deeply pinnatisect, lanceolate to oblanceolate, chartaceous to coriaceous, glabrous, glaucous beneath; ultimate segments mostly linear, retuse, slightly dilated toward the base, margins revolute; veins 2- to 4-forked, approximate; sori medial or, more commonly, inframedial between midrib and margin; mature sporangia usually yellowish brown, about 8-20 per sorus; spores monolete.

GLEICHENIA Smith

Reference: R. C. Ching, On the genus *Gleichenia* Smith, *Sunyat-senia* 5: 269-289. 1940.

Rhizome provided with narrow, setose or short-ciliate scales; leaves widely or (rarely) closely spaced, 2 m. or more in length (in ours); petiole suberect to ascending, stout, rigid, terete or somewhat flattened on the adaxial side near the basal pinnae, bearing a pair of opposite, ascending pinnae, with an arrested bud at its apex, or continued as the rachis which subsequently produces one or two more opposite pairs of pinnae; pinnae bipinnate, or (more typically) once to several times pseudodichotomous with the penultimate segments in diverging, subequal, pectinate (in ours) pairs; a dense tuft of pale to dark, lanceolate to ovate, usually acuminate scales within each fork, and often flanked by one or two pairs of reduced, stipule-like appendages; ultimate segments rigidly chartaceous to subcoriaceous, commonly glabrous above, variously pubescent or tomentose and often whitish or yellowish granulose beneath; veins simple or (in ours) once-forked; sori exindusiate, each with 2 to 5 sporangia; spores trilete or monolete, commonly (in ours) lacking ornamentation.

More than 100 species are included in this genus, with distribution in tropical to south temperate areas of both hemispheres.

- a. Pinnae bipinnate, not forked; axillary scales entire *G. bancroftii*.
- a. Pinnae once to several times pseudodichotomous, the penultimate segments pectinate-pinnatisect; axillary scales ciliate or setose.
- b. Sori mostly inframedial, crowding or touching the midrib; segments densely and evenly tomentose beneath.

- c. Costal scales on abaxial side copious, orange, long-ciliate, 1-2 mm. long, axillary scales orange to reddish brown, lax, mostly long-ciliate. *G. bifida*.
- c. Costal scales on abaxial side essentially lacking, or (more often) scattered, dark brown to blackish or dark-centered, often setose, less than 1 mm. long; axillary scales dark brown to blackish, rigid, mostly short-ciliate or setose. *G. brevipubis*.
- b. Sori mostly medial to supramedial, rarely crowding the midrib (except on strongly revolute segments); segments not tomentose, or rarely (in *G. underwoodiana*) with tomentum confined to the area along the midrib.
- d. Midribs of ultimate segments commonly provided beneath (at least near the base) with orange to reddish brown, ciliate sometimes hairlike, scales, and abundant, orange to reddish brown, stellate trichomes *G. underwoodiana*.
- d. Midribs of ultimate segments lacking scales (or rarely with some scattered whitish or yellow hairlike ones), but sparsely provided beneath with whitish or yellow stellate trichomes. *G. palmata*.

Gleichenia bancroftii Hook. Sp. Fil. 1: 5. 1844. *Mertensia bancroftii* Kunze, Linnaea 18: 307. 1844. *Dicranopteris bancroftii* (Hook.) Underw. Bull. Torrey Bot. Club 34: 252. 1907. *Hicriopteris bancroftii* (Hook.) Ching, Sunyatsenia 5: 278. 1940.

Commonly on slopes and sides of ravines in open forests, with leaves clambering over shrubs and trees, 1,650-3,200 m. Baja Vera-paz; Huehuetenango; San Marcos; Zacapa. Southern Mexico; Honduras; El Salvador; Costa Rica; West Indies; Colombia; Venezuela; Ecuador; Peru; Bolivia.

Rhizome stout, to 6 mm. in diameter, smooth or slightly muricate, long-creeping on or just beneath the surface of the ground, provided with appressed, yellowish brown or grayish brown scales; leaves widely spaced; petiole stout, mostly smooth and lustrous, terete, or somewhat flattened on the adaxial side near the basal pinnae, stramineous to light brown and glabrous above, often darker and scaly at the base; pinnae bipinnate; bud of primary axil thickly beset with entire, whitish or yellowish, lanceolate to ovate, acuminate scales; pinnae 0.5-1.5 m. long, to 40 cm. broad, with costa glabrous, or with a few narrow scales at bases of penultimate segments, terete beneath, slightly bicarinate above; pinnules numerous, crowded, spreading at nearly right angles from the costa, sessile, linear, pectinate nearly or quite to the costule; ultimate segments linear, chartaceous or subcoriaceous, acute strongly revolute, slightly dilated at base, often with scales scattered along midrib; veins once (rarely twice) forked; sori inframedial between midrib and margin, with 2 to 5 sporangia, subtended by a cluster of yellowish trichomes; spores trilete.

Within the family this is the only species in the neotropics having the pinnae bipinnate and unforked. It should be confused with no other species in Guatemala.

Gleichenia bifida (Willd.) Sprengel, Syst. Veg. ed. 16, 4: 27. 1827. *Mertensia bifida* Willd. Kongl. Vetensk. Acad. Nya Handl. II, 25:

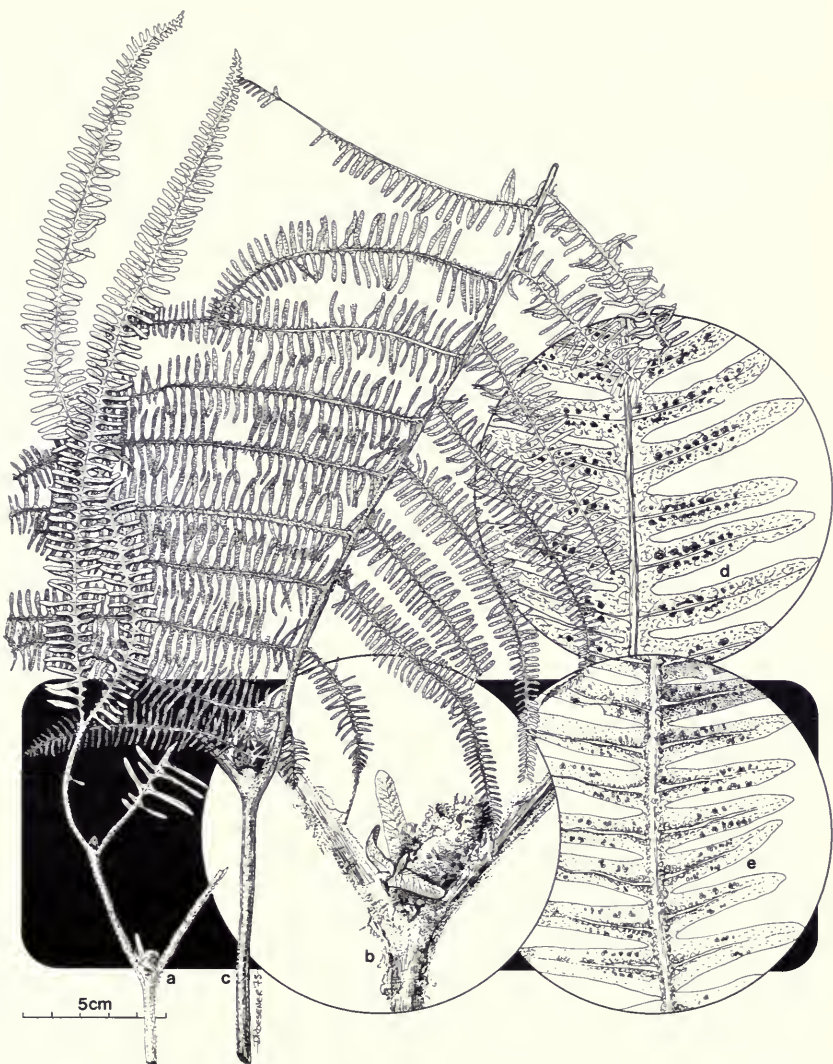


FIG. 11. *Gleichenia*. a-b, *G. palmata*: a, habit, $\times \frac{1}{2}$; b, bud of primary axil, showing scales and stipule-like appendages, $\times \frac{1}{2}$; c, *G. bancroftii*, habit, $\times \frac{1}{2}$; d, *G. bifida*, ultimate segments, showing sori crowding midrib, $\times 3$; e, *G. underwoodiana*, ultimate segments, showing tomentum along midrib, and sori distant from midrib, $\times 3$.

168. 1804. *M. fulva* Desv. Mém. Soc. Linn. Paris 6: 200. 1827. *Dicranopteris fulva* (Desv.) Underw. Bull. Torrey Bot. Club 34: 255. 1907. *D. bifida* (Willd.) Maxon, North Amer. Fl. 16: 60. 1909. *Sticherus bifidus* (Willd.) Ching, Sunyatsenia 5: 282. 1940. *Chispa* (Baja Verapaz).

In forests and damp thickets or open or brushy slopes, 400-2,300 m. Alta Verapaz; Baja Verapaz; Huehuetenango; Izabal; Quezaltenango; San Marcos. West Indies; Mexico to Panama; Colombia and Venezuela southward to Bolivia and Brazil.

Rhizome long-creeping, often branched, dark brown, provided with reddish brown, setose or short-ciliate, linear, acuminate scales; leaves widely spaced; petiole stout, suberect, smooth, dull or somewhat lustrous, terete, yellowish brown to greenish brown (rarely reddish), mostly glabrous, except sometimes scaly at apex and base; bud of primary axil thickly covered with orange to reddish, long-ciliate, ovate to lanceolate, acuminate scales, and often flanked by a pair of reduced, stipule-like appendages; pinnae once- or twice-pseudodichotomous, with an arrested bud (or rarely a secondary axis) produced at the apex, scaly as in the primary axil; scales on the axes orange, long-ciliate, often dense; secondary axes 2-6 cm. long, not pectinate or only partly so on the acroscopic side; tertiary axes 3-10 cm. long, pectinate, or partly so on the acroscopic side; penultimate segments (20) 30-60 cm. long, 3-7 cm. broad, pectinate, cut nearly to the costa, lanceolate, mostly subcoriaceous; costa above glabrous or provided with orange or whitish, mostly stellate trichomes, beneath with abundant, conspicuous (1-2 mm. long) spreading, orange, ciliate scales; ultimate segments linear to linear-lanceolate, obtuse to acute, slightly or strongly revolute, densely and evenly tomentose with orange or yellowish, stellate trichomes and a few hairlike scales, sometimes whitish or partly deciduous in age; veins 15-40 pairs, once-forked; sori mostly inframedial, crowding or touching the midrib, with 3 to 4 sporangia; spores monolete, bean-shaped.

Gleichenia bifida can usually be easily distinguished from other species (except *G. brevipubis*) in our area by the dense tomentum on the abaxial side of the segments, in which the sori are often quite deeply immersed. In some specimens of *G. underwoodiana*, pinna segments may be quite densely villous along the midrib, but are much less so toward the margin. Pinna segments of *G. bifida* (except those glabrescent with age) are densely and evenly tomentose throughout.

The common name "chispa" apparently refers to the combustible nature of the spores, which produce a sparkling display when poured over an open flame.

Gleichenia brevipubis Christ, Bull. Herb. Boissier II. 6: 280. 1906. *Palma cateje*; *venado del río* (fide Steyermark, Quezaltenango).

In thickets and on moist, open banks and ravines, 1,200-2,700 m. Alta Verapaz; El Progreso; Quezaltenango; San Marcos; Suchitepéquez. Jamaica; Mexico to Costa Rica.

Rhizome branched, long-creeping, dark brown, provided with dark brown, setose or short-ciliate, linear, acuminate scales; leaves closely to widely spaced; petiole stout, suberect, smooth, dull or somewhat lustrous, terete, stramineous, or greenish to reddish brown, glabrous, or with a few scattered scales at base; bud of primary axil thickly covered with blackish, dark brown or dark-centered, rigid, setose or short-ciliate, linear-lanceolate to lance-ovate scales (or rarely some with longer, white cilia) and often flanked by a pair of reduced, stipule-like appendages; pinna once- or twice-pseudodichotomous, with an arrested bud (or rarely a secondary axis) produced at the apex, these scaly as in the primary axil; scales on the axes lacking, or scattered, minute, reddish brown or blackish; secondary and tertiary axes 4-12 cm. long, wholly pectinate, or partly so on the acroscopic side; penultimate segments (20) 24-40 cm. long, pectinate, cut nearly to the costa, lanceolate, mostly subcoriaceous; costa above glabrous, or provided with scattered, blackish scales or whitish, stellate trichomes, beneath with scattered, minute (less than 1 mm.), often appressed, dark brown or dark-centered, commonly setose, scales and usually with a few inconspicuous, orange, often hairlike ones; ultimate segments linear to linear-lanceolate, obtuse to acute, slightly or strongly revolute, densely and evenly tomentose with whitish or yellowish, stellate trichomes and a few hairlike scales; veins 18-30 pairs, once-forked; sori mostly inframedial, crowding or touching the midrib, with 3 to 4 sporangia; spores monolete, bean-shaped.

Maxon considered this conspecific with *G. bifida*, and perhaps it merits only varietal status. However, the two probably differ from each other to the same extent that *G. palmata* differs from *G. underwoodiana*, especially as to the scales of axes, axils, and costae. Throughout the range, *G. brevipubis* varies somewhat in scale characters. In southern Central America the black, setose costal scales are usually quite numerous, whereas farther north these scales are often widely scattered to nearly lacking. In addition, the secondary axes of *G. brevipubis* are often pectinate, on both sides of the axis, whereas those of *G. bifida* are never wholly pectinate. But this is not always a reliable character, for on some specimens the secondary axes of *both* species can be pectinate *only* on the acroscopic side. Furthermore, the secondary axes are not always available for examination, having been omitted by collectors, due to lack of space on the herbarium sheet. The entire species complex needs a thorough, updated study to clarify specific and infraspecific relationships.

Gleichenia palmata (Underw.) C. Chr. Index Fil. Suppl. 1: 113. 1913. *Mertensia palamata* Schaffner in Fée, Mem. Fam. Foug. 9: 40 (seors. 32). 1857. *nom. nud.* *Gleichenia palmata* (Schaffner) Moore, Index Fil. 380. 1862. *nom. nud.* *Dicranopteris palmata* Underwood,

Bull. Torrey Bot. Club. 34: 259.1907 (type from Orizaba, Veracruz, Mexico, *Pringle 6129*). *Sticherus palmata* (Underw.) Copel. Gen. Fil. 28. 1947.

On mountain slopes and sides of ravines in forest, 1,100-2,600 m. Alta Verapaz; Baja Verapaz; Chiquimula; Guatemala (?); San Marcos; Zacapa. Cuba; Jamaica; Southern Mexico; Honduras.

Rhizome branched, long-creeping near surface of ground, dark brown to atropurpureous, provided with reddish brown, setose or short-ciliate scales; leaves widely spaced; petiole stout, suberect, smooth but not lustrous, terete, or somewhat flattened on the adaxial side near the basal pinnae, yellowish to greenish and glabrous above, dark brown, lightly tuberculate and scaly at the base; bud of primary axil thickly covered with ciliate, reddish brown, lanceolate to ovate, acuminate scales, and flanked by 1 or 2 pair of reduced, stipule-like appendages; pinnae once to several times pseudodichotomous, with an arrested bud (or rarely with a secondary axis) produced at the apex, these scaly and appendaged as in the primary axil; scales on the axes reddish brown to whitish, long-ciliate, usually confined to the acroscopic side; secondary axes 4-8 cm. long, not pectinate; tertiary axes 3-4 cm. long, not pectinate, or rarely partly so on the acroscopic side; quaternary axes commonly fully pectinate as in the penultimate segments; penultimate segments 12-25 cm. long, 2-4 cm. broad, pectinate, cut nearly or fully to the costa, lanceolate, chartaceous to subcoriaceous; costa above glabrescent or provided with scattered to abundant reddish brown, orange or whitish, often hairlike scales, beneath with abundant, reddish brown or (rarely) orange, ciliate scales; ultimate segments linear, obtuse to subacute, slightly to strongly revolute, faintly white- or yellow-granulose beneath, the midribs, veins and tissue beneath lacking scales, but lightly pubescent with white or yellow, stellate, scattered trichomes (rarely a few pale, delicate, hairlike scales present on midrib); veins 10-30 pairs, once-forked; sori medial to supramedial between midrib and margin, with 3 to 5 sporangia; spores monolete, bean-shaped.

Specimens of *Gleichenia palmata* can be confused with those of *G. underwoodiana* that are not densely pubescent. Segment midribs of the latter are typically provided with abundant, reddish, stellate trichomes and (at least in the proximal portion) rather conspicuous reddish brown, ciliate scales; whereas the midribs in *G. palmata* are provided merely with a light scattering of white or pale yellow trichomes. But even when pubescence is light in *G. underwoodiana*, and scales may be nearly lacking on the midrib, the indument is decidedly darker in color than the pale trichomes of *G. palmata*. In addition, the tertiary axes in *G. underwoodiana* are typically pectinate, at least on the acroscopic side. In *G. palmata*, the tertiary axes are not pectinate or, rarely, have reduced segments on the acroscopic side.

Gleichenia underwoodiana (Maxon) C. Chr. Index Fil. Suppl. 1: 44. 1913. *Dicranopteris underwoodiana* Maxon, North Amer. Fl. 16:

59. 1909 (type from Chiapas, *Ghiesbreght* 271). *Sticherus underwoodianus* (Maxon) Nakai, Bull. Natl. Sci. Mus. Tokyo 29: 31. 1950.

On moist, shaded, mountain slopes and stream banks, 2,000-3,200 m. Chimaltenango; Huehuetenango; El Quiché; San Marcos; Zacapa. Mexico; Honduras; El Salvador; Costa Rica.

Rhizome branched, long-creeping, dark brown to atropurpureus, provided with reddish brown, setose to short-ciliate scales; leaves widely spaced; petiole stout, suberect, smooth, somewhat lustrous, terete, yellowish brown to greenish brown or atropurpureus, glabrous, or sometimes scaly at apex and base; bud of primary axil thickly covered with ciliate, reddish brown, lanceolate to ovate, acuminate scales and flanked by 1 or 2 pair of reduced, stipule-like appendages; pinna once to several times pseudodichotomous, with an arrested bud (or rarely a secondary axis) produced at the apex, these scaly and often appendaged as in the primary axil; scales on the axes reddish brown to whitish, long-ciliate, usually confined to the acroscopic side; secondary axes 3-12 cm. long, not pectinate, or (rarely) only partly so on acroscopic side; tertiary axes 4-8 cm. long, pectinate, or partly so on acroscopic side; quaternary axes fully pectinate as in the penultimate segments; penultimate segments 10-28 cm. long, 1.5-3.2 cm. broad, pectinate, cut nearly or fully to the costa, lanceolate, chartaceous to subcoriaceous; costa above glabrescent or provided with scattered to abundant reddish brown, orange or whitish, often hairlike scales, beneath with abundant, reddish brown or (rarely) orange, ciliate scales; ultimate segments linear, obtuse to acute, slightly to strongly revolute, white- or yellow-granulose beneath, the midribs often densely tomentose and scaly, provided (at least in the proximal third) with orange to reddish brown scales and stellate trichomes, the veins with orange to reddish brown trichomes, the tissue glabrous; veins 16-22 pairs, once-forked; sori medial to supramedial between midrib and margin, with 3 to 5 sporangia; spores monolete, bean-shaped.

This species has been combined with *G. compacta* Christ in some herbaria. However, a type fragment of the latter at U.S. National Herbarium has obviously inframedial sori, and blackish and dark setose costal scales, which indicates closer affinity with *G. brevipubis* than with *G. underwoodiana*.

HYMENOPHYLLACEAE

References: C. B. Presl, Hymenophyllaceae, Abh. Böhm. Ges. Wiss. V. 3: 93-162. 1843. R. van den Bosch, Synopsis Hymenophyllacearum, Ned. Kruidk. Arch. 4: 341-419. 1859, and Supplement *op. cit.* 5: 135-185. 1861. K. Prantl, Die Hymenophyllaceen, Untersuch. Morph. Gefässkrypt. I: 3-14. 1875. E. B. Copeland, Genera Hymenophyllacearum, Philipp. J. Sci. 67: 1-110. 1938. C. V. Morton, The genera, subgenera and sections of the Hymenophyllaceae, Contr. U.S. Natl. Herb. 38: 153-214. 1968.

Medium-sized, small or minute, usually delicate, epiphytic plants, or a few terrestrial; rhizome thin and long-creeping with leaves widely spaced, or (less commonly) stout, ascending to erect with leaves fasciculate, provided with scattered, simple, light brown, reddish or blackish trichomes; leaves commonly monomorphous, or rarely dimorphous in *Trichomanes*, typically circinate in veneration, not articulate at the rhizome; lamina flabellate, or pinnatifid to decompose, variously pubescent, scales lacking (except some marginal scalelike processes present in *T. membranaceum*), the tissue 1 cell thick, lacking stomata; venation anadromous, or often catadromous in *Trichomanes*, free or in a few species reticulate; sori marginal, terminal on the veins; indusium immersed to short-stalked, bivalvate deeply or fully to base, or tubular to salverform with an entire or bilabiate mouth; receptacle short and rudimentary or filiform to thickly cylindrical or narrow-turbinate, not or long-exserted from the indusium at maturity; sporangia sessile, borne on all sides of the receptacle, each with uninterrupted, oblique annulus, borne on all sides of the receptacle, each with uninterrupted, oblique annulus, dehiscing more or less longitudinally; spores tetrahedral to subglobose, trilete, white or, more commonly greenish, 32-420 (fide Bower) in each sporangium.

The "filmy ferns" constitute a natural and distinctive, predominantly tropical, family containing 550-600 species. Two genera, subequal in size, are recognized here, although 30 or more have been proposed by earlier workers. Most species are all to minute, with laminar tissue rarely more than one cell thick. Sori are always marginal, with the indusium tubular (cylindrical to salverform) in *Trichomanes* or deeply bivalvate in *Hymenophyllum*. They are typically epiphytes of dark, wet forests and are of no importance to man, except in an aesthetic sense. With their delicate, filmy leaves and usually pendent habit, they are among the loveliest and most graceful of all ferns.

- a. Indusium obviously bivalvate (often fully to base), never tubular, the valves constituting the major part of the indusium; receptacle filiform or thickened, not or slightly exserted; venation anadromous *Hymenophyllum*.
- a. Indusium tubular, obconic or salverform, sometimes bilabiate, the tubular portion constituting an equal or major part of the indusium; receptacle filiform, somewhat to greatly exserted at maturity; venation anadromous or catadromous *Trichomanes*.

HYMENOPHYLLUM J. E. Smith

Reference: C. V. Morton, The American species of *Hymenophyllum* section *Sphaerocionium*, Contr. U.S. Natl. Herb. 29: 139-201. 1947.

Plants epiphytic or occasionally terrestrial; rhizome long-creeping, commonly sparsely provided with brown or reddish trichomes; leaves monomorphous, simple or (in ours) pinnatisect to decompose, determinate or indeterminate, commonly 2-60 cm. long, short- to long-petiolate; petiole delicate, wiry or stout, terete and

smooth, shorter than the lamina, nonalate or marginate, to broadly alate for most or part of its length, glabrous, or provided with simple to stellate trichomes; lamina subflabellate to ovate to linear, glabrous or variously provided with simple to stellate trichomes; venation free, subflabellate or (most commonly) pinnate, anadromous, spurious veins absent; ultimate segments usually narrow, often filiform, the margins entire or serrate; indusium partly or not at all immersed in the tissue, suborbicular to elliptic or obovate, bivalvate deeply or fully to base, the base often conic but never tubular; receptacle filiform to thickened, cylindrical to narrowly turbinate, rudimentary or short or somewhat exserted at maturity; spores tetrahedral to subglobose, trilete, smooth to variously sculptured, white or, more commonly, greenish.

Approximately 250-300 species of *Hymenophyllum* are found throughout the world. Although essentially a tropical genus, some of its species occur in subtropical latitudes, and a few even in wet temperate areas. They are mostly epiphytic plants, but have been occasionally reported from wet, rocky banks in dense forests. The genus (especially the American species) is much in need of good, monographic work. Morton's study of section *Sphaerocionium* was a beginning, but confusion still exists among species of subgenera *Mecodium* and *Hymenophyllum*. Consequently, a few of the species concepts herein are provisionally treated.

- a. Ultimate segments sharply and deeply serrate throughout, the serrations commonly remote (Subgenus: *HYMENOPHYLLUM*).
 - b. Indusium entire or serrulate near apex; sori 1-2 at acroscopic base of pinna (rarely also with 1 on basiscopic side); receptacle often much-exserted at maturity; elev. 1,250-3,150 m. *H. fucoides*.
 - b. Indusium lacinate to subciliate in apical half; sori 1-5 along acroscopic side of pinna, and often 1-2 (3) on basiscopic side; receptacle slightly or not at all exserted; elev. 300-1,200 m. *H. ectocarpon*.
- a. Ultimate segments entire (sometimes undulate to strongly crisped, but never serrate).
 - c. Lamina glabrous (Subgenus: *MECODIUM*).
 - d. Lamina essentially pinnate or pinnatifid, the primary segments simple to bifid (or proximal ones sometimes subflabellate or pinnatifid); segments plane to slightly undulate.
 - e. Lamina (of mature leaves) 4-14 cm. long; ultimate segments mostly 2-3 mm. broad. *H. asplenoides*.
 - e. Lamina rarely over 2.5 cm. long; ultimate segments mostly 1-1.5 mm. broad.
 - f. Pinnae 3-7 pairs; lamina (of mature leaves) 1.5-2.5 cm. long, ovate to elliptic, the basal pinnae either reduced or strongly ascending, thus the lamina appearing tapered to base. *H. abruptum*.
 - f. Pinnae 1-2 (3) pairs; lamina 0.5-1.2 cm. long, subflabellate, basal ones spreading, thus the lamina truncate at base. *H. brevifrons*.
 - d. Lamina bipinnatifid to tripinnatifid; ultimate segments plane, undulate, or strongly crispate.

- g. Ultimate segments conspicuously crispate, often so strongly as to appear dentate or deeply lobed *H. contortum*.
- g. Ultimate segments plane, undulate or slightly crispate.
 - h. Petiole .01-.02 mm. thick, neither alate nor marginate; lower half of rachis nonalate or essentially so; lower 2-4 pinnae short-stalked *H. undulatum*.
 - h. Petiole (of mature leaves) 0.3-0.7 mm. thick, often marginate or alate; rachis alate throughout; pinnae adnate or basal one short-stalked.
 - i. Lamina not or scarcely narrowed at base; the lowermost pair of pinnae somewhat or not at all reduced; lamina 1.5-2.5 times longer than broad, and 1.5-3.5 times longer than the petiole; fertile segments not usually constricted at apex, the indusium slightly immersed in the tissue *H. polyanthos*.
 - i. Lamina gradually narrowed at base, with the lower 3-5 pairs of pinnae somewhat to greatly reduced; lamina 3-8 times longer than broad, and 4-7 times longer than the petiole; fertile segments often greatly constricted, thus the indusium appearing stalked. *H. myriocarpum*.
- c. Lamina provided with trichomes, at least on margins or veins (Subgenus: *SPHAEROCIONUM*).
 - j. Trichomes borne on abaxial and adaxial leaf surfaces as well as on veins and/or margins (Subsection: *HIRSUTA*).
 - k. Leaves 2-6 cm. long and 1-1.5 cm. broad, determinate; petiole delicate, 0.1-0.2 mm. thick; pinnae simple or bifid, or rarely some basal ones sublabelate.
 - l. Stellate trichomes on segment margins sessile or subsessile; petiole trichomes mostly simple or bifurcate; pinnae mostly bifid *H. fragile*.
 - l. Stellate trichomes on segment margins obviously stalked; petiole trichomes mostly stellate; pinnae mostly simple. *H. lanatum*.
 - k. Leaves (mature) 8-60 cm. long and 2.5-8 cm. broad, indeterminate; petioles wiry or stout, 0.3-0.9 mm. thick (except 0.2-0.25 mm. in *H. elegantulum*); pinnae 1- or 2-pinnatifid.
 - m. Petiole wiry, 0.2-0.25 mm. thick, sparsely provided with simple (rarely a few bifurcate) trichomes. *H. elegantulum*.
 - m. Petiole stout, 0.3-0.9 mm. thick, sparsely to abundantly provided with mixed, mostly stellate, trichomes.
 - n. Trichomes of segment margins stellate, obviously stalked, delicate, the rays spreading; petiole 0.3-0.5 mm. thick, alate at least near apex; pinnae essentially pinnatifid, the secondary segments mostly simple to bifid *H. sieberi*.
 - n. Trichomes of segment margins stellate, sessile or subsessile, stout, the rays commonly appressed and directed toward segment tip; petiole (0.5) 0.6-0.9 mm. thick, nonalate; pinnae essentially bipinnatifid, the larger secondary segments deeply pinnatifid *H. crassipetiolatum*.
 - j. Trichomes lacking between veins and margins (Subsection: *CILIATA*).
 - o. Petiole alate, at least near apex; rachis alate throughout.
 - p. Trichomes on segment margins mostly simple, or once-forked at base, rather widely scattered; trichomes lacking (or rare) on veins adaxially.
 - q. Petiole delicate, ca. 0.2 mm. thick, rarely more than 3 cm. long; petiolar trichomes mostly simple, scattered. *H. crispum*.

- q. Petiole stout, commonly 0.5-0.8 mm. thick and 3-9 cm. long; petiolar trichomes (when present) mostly stellate. *H. microcarpum*.
- p. Trichomes on segment margins mostly bifurcate or stellate, usually abundant; trichomes present (sometimes sparse) on the veins of both sides.
- r. Petiole conspicuously alate one-half to three-quarters to base, with trichomes mostly stellate; larger pinnae with 2-4 pairs of segments. *H. hirsutum*.
- r. Petiole alate only at apex (or rarely one-third to base), with trichomes mostly simple or bifurcate; larger pinnae commonly with 4-7 pairs of segments. *H. maxonii*.
- o. Petiole nonalate throughout; rachis nonalate at base, or nearly throughout.
- s. Trichomes on veins and margins stellate, usually abundant; rachis nonalate nearly throughout; leaves indeterminate.
- t. Pinnae commonly pinnate, the costae not continuously alate on both sides; pinnae (some of them) elongate, often becoming frondlike and greatly exceeding the adjacent ones. *H. tricophyllum*.
- t. Pinnae merely pinnatifid, thus the costae continuously alate on both sides; pinnae (except reduced basal pairs) subequal to adjacent ones. *H. pulchellum*.
- s. Trichomes on margins mostly simple or bifurcate, on veins rare or lacking; rachis alate in the distal portion; leaves determinate.
- u. Indusia (most of them) much broader than the ultimate segments; rachis of mature leaves commonly nonalate in proximal half of lamina. *H. lineare*.
- u. Indusia as broad or scarcely broader than the ultimate segments; rachis of mature leaves alate (or pinnae conspicuously decurrent) except near base of lamina. *H. elegans*.

Hymenophyllum abruptum Hook., Sp. Fil. 1: 88, *t.* 31*b.* 1844.
Leptocionum abruptum Presl, Abh. Böhm. Ges. Wiss. V: 336. 1848.
Mecodium abruptum (Hook.) Copel. Philipp. J. Sci. 67: 26. 1938.

In deep shade, on trees or rotting logs in forests, 1,000-2,500 m.; Alta Verapaz; Chiquimula; Zacapa. Greater Antilles.

Plants commonly epiphytic; rhizome thin, long-creeping, delicate, essentially glabrous; leaves glabrous, determinate, subdistant on the rhizome, often forming dense mats, mature ones 2-4 cm. long; petiole delicate, essentially glabrous, 0.5-2 cm. long, ca. 0.1 mm. in diameter, nonalate; lamina 1.5-2.5 (3.3) cm. long, pinnatisect, ovate, elliptic, or oblong, the basal pinnae strongly ascending (occasionally reduced) thus the lamina tapered to base; rachis narrow-alate (due to the decurrent pinnae), or nonalate at base, with the basal pinnae subdistant; pinnae 3-7 pairs, simple or bifid, the ultimate segments 1.5-1.7 mm. broad, entire, plane or slightly undulate, the apices retuse; sori 1-4, obturbinate, terminating the apical segments; indusia entire, as broad as or broader than the segments, deeply immersed, bivalvate one-half to two-thirds to the cuneate base; receptacle narrow-cylindric, somewhat exserted at maturity.

This species and *H. brevifrons* are easily confused, as both are minute, delicate, and roughly similar in leaf outline. However, the

basal pinnae of the latter commonly spread from the rachis at nearly right angles, so that most laminae have a truncate appearance. Basal pinnae of *H. abruptum* are most often strongly ascending, or they are sometimes greatly reduced; in either case the lamina appears to be tapered to base. Although the rachis is characteristically alate in both species, the wing may be often lacking in *H. abruptum* between the two lowest pinnae, and the basal pinna is occasionally subpetiolulate.

Hymenophyllum asplenioides (Sw.) Sw. J. Bot. (Schrader) 1800(2): 98. 1801. *Trichomanes asplenioides* Sw. Prodr. 136. 1788. *Mecodium asplenioides* (Sw.) Copel. Philipp. J. Sci. 67: 26. 1938.

Pendent from tree trunks and branches, in wet forests, 1,200-2,000 m.; Alta Verapaz; Baja Verapaz; Chiquimula. Mexico; Honduras; Nicaragua; Costa Rica; Panama; West Indies; Venezuela; British Guiana; Brazil.

Plants epiphytic; rhizome thin, long-creeping, delicate, glabrous or with a few, scattered light brown, simple trichomes; leaves glabrous, determinate, distant on the rhizome, mature ones 5-15 cm. long; petiole glabrous, delicate, 1-5 cm. long, 0.2-0.3 mm. in diameter, nonalate; lamina 4-14 cm. long, pinnatisect, oblong or linear, not or slightly reduced at base, the rachis alate throughout, or occasionally nonalate at the very base; pinnae 4-15 pairs, decurrent, simple to bifid, or lower ones subflabellate or shallowly pinnatifid; ultimate segments mostly 2-3 mm. broad, entire, plane or slightly undulate; sori numerous, terminating most of the ultimate segments; indusia entire, as broad or slightly broader than the ultimate segments, scarcely or not at all immersed, bivalvate to the arcuate or subtruncate base; receptacle narrow-cylindric, short, not exserted.

Hymenophyllum brevifrons Kunze, Bot. Zeit. 185. 1847. *H. tabla-ziense* Christ, Bull. Soc. Bot. Genève II. 1: 216. 1909. *Mecodium tabla-ziense* (Christ) Copel. Philipp. J. Sci. 67: 26. 1938.

On tree trunks, or sometimes on clay or limestone banks, in forests, near sea level; Izabal. British Honduras; Nicaragua; Costa Rica; Panama; West Indies; the Guianas.

Plants usually epiphytic; rhizome thin, creeping, delicate, essentially glabrous; leaves glabrous, determinate, subsistant on the rhizome, often forming dense mats, mature ones 1-2 cm. long; petiole glabrous, delicate, 0.1-1 cm. long, 0.1-0.15 mm. in diameter, not alate, or scarcely so at apex; lamina 0.5-1.2 cm. long, pinnatisect, subflabellate, the basal pinnae spreading, thus the lamina truncate at the base; rachis broadly alate throughout, with pinnae crowded or imbricate; pinnae 1-2 (3) pairs, simple or bifid (or sometimes the basal ones again bifid), the ultimate segments 1-1.5 mm. broad, entire, plane or slightly undulate, the apices retuse; sori 1 or 2 (3), obturbinate, terminating the apical segments; indusia entire, as broad or broader than the segments, deeply immersed, bivalvate one-half to two-thirds to the cuneate base; receptacle narrow-cylindric, somewhat exserted at maturity.



FIG. 12. *Hymenophyllum*. a-b, *H. fucoides*: a, habit, $\times 1$; portion of lamina, showing serrate segments, $\times 2$; c, *H. polyanthos*, portion of lamina, showing entire segments, $\times 2$; d-e, *H. crispum*: d, habit, $\times 1$; e, portion of lamina, $\times 4$; f-g, *H. lanatum*: f, habit, $\times \frac{1}{2}$; g, apex of lamina, $\times 3\frac{1}{2}$.

Further comparison of this species with *H. abruptum* appears under discussion of the latter.

Juvenile or depauperate specimens of *H. polyanthos* and *H. myriocarpum* are frequently determined as *H. brevifrons*. In these stages, leaves of the former may be not only minute, but the pinnae also quite crowded, thus approximating the subflabellate appearance of *H. brevifrons*; hence a combination of characters must be compared for proper identification. In *H. brevifrons* the petiole is always glabrous, nonalate (except sometimes at the apex), and very delicate: 0.1-0.15 mm. in diameter. The pinnae are always simple or bifid, although the basal pair may be sometimes twice bifid. Each leaf bears only 1-2 (3) terminal sori. In *H. polyanthos* and *H. myriocarpum* petioles (even in depauperate specimens) are often alate or marginate, at least partially to base, with a few reddish trichomes, and are commonly about 0.3 mm. (rarely 0.2 mm) in diameter. Most pinnae are pinnately divided, and sori are 2-several — not necessarily terminal on the blade.

With *H. brevifrons* perhaps belongs *H. brevistipes* Liebm. of Mexico. I have not seen the type of the latter, but Liebmann's description (Kongel. Danske Vidensk. Selsk. Skr. V. 1: 290 [seors. 138] 1849) indicates no significant differences, nor do specimens so identified in herbaria.

Hymenophyllum contortum v.d. Bosch, Ned. Kruidk. Arch 5: 170. 1863. *Mecodium contortum* (v.d. Bosch) Copel. Philipp. J. Sci. 67: 26. 1938.

On tree trunks or moist banks, in forests, 1,200-1,500 m.; Alta Verapaz. Southern Mexico; Costa Rica; Colombia; Venezuela; Peru (?).

Plants usually epiphytic; rhizome thin, delicate, provided with scattered, simple, reddish trichomes; leaves subdistant on the rhizome, mature ones (in ours) 5-15 cm. long; petiole 1.2-6 cm. long, 0.15-0.2 mm. in diameter, provided at base with a few simple, reddish trichomes or glabrescent, nonalate; lamina 3.5-9 cm. long (in ours), 1.2-2 cm. broad, glabrous throughout, 2- to 3-pinnatifid, gradually or not at all narrowed to the base, the lower 1-4 pairs of pinnae somewhat to greatly reduced; rachis mostly alate, but nonalate in proximal portion of lamina, the wing conspicuously crispate; pinnae numerous, adnate, or one or two proximal ones short-stalked; ultimate segments 0.5-1 mm. broad, entire, but contorted (often appearing almost dentate or lobed) due to the strongly crispate tissue; sori several and terminal or lateral on each pinna; indusia as broad or broader than the ultimate segments, the valves suborbicular, broadly ovate or elliptic, slightly or not immersed at the cuneate or truncate base, often appearing stalked due to the constricted or strongly crispate segment tip; receptacle narrow-cylindric, short or rudimentary.

The question of whether or not *Hymenophyllum contortum* is truly distinct from *H. undulatum* must be resolved by future study. The few collections available from Guatemala and other Central American areas appear to be sufficiently different from *H. undulatum*, but in some specimens further outside our range the differences are less obvious. Generally, at least in our area, *H. contortum* is a rather small, inconspicuous plant, rarely over 15 cm. long, with blade only about two or three times the length of the petiole, and quite appropriately named for the severely contorted tissue of the rachis wing and ultimate segments. *H. undulatum* is typically a slender, graceful plant, festooning tree trunks and branches in long, delicate strands. The lamina is usually six to eight times as long as the petiole, and the ultimate segments are rather gently undulating, rarely (if at all) slightly crispate. However, leaf shape and degree of crisping of the tissues are about the only significant differences between the two, and these do not appear to hold up very well throughout the entire range. There are some South American and West Indian plants much less elongated than in the typical condition of *H. undulatum*, and, at least in portions of the leaves, the segments appear more than merely "undulate." Subgenus *Mecodium* in the New World is long overdue for good monographic study, and only at that time can the precise relationship of the two taxa be ascertained.

***Hymenophyllum crassipetiolatum* Stolze, Amer. Fern J. 66: 15-18. 1976.**

Pendent from tree trunks, or growing on moist banks, in deep shade in cloud forests, 1,250-3,300 m.; Alta Verapaz; Baja Verapaz; Chiquimula; El Progreso; El Quiché; Zacapa. Mexico (Chiapas); Honduras; El Salvador.

Plants epiphytic or terrestrial; rhizome wiry, long-creeping, provided with simple, reddish to light brown trichomes; leaves subdistant on the rhizome, indeterminate, pendent, mature ones 12-42 cm. long, 3-8 (10) cm. broad; petiole 4-11 (16) cm. long, (0.5) 0.6-0.9 mm. in diameter, nonalate (although basal pinna sometimes short-decurrent), sparsely to abundantly provided with simple, bifid, or (mostly) stalked, stellate trichomes; lamina ovate or, more commonly, narrow-lanceolate, not reduced at base, or the lower 1-4 pairs of pinnae somewhat shorter; rachis broadly alate throughout, or nonalate at base, the wings plane to slightly crispate, sparsely or abundantly provided with sessile or subsessile, stellate trichomes; pinnae commonly bipinnatifid, the costae broadly alate; pinna segments 4-12 pairs, the larger ones deeply pinnatifid, the apical ones bifid to simple; ultimate segments plane or slightly undulate, entire, veins and leaf surfaces sparsely to abundantly provided with sessile, stellate trichomes; marginal trichomes abundant, sessile-stellate, most of

the 4-6 stout rays commonly appressed and directed toward the segment tip; indusium as broad or broader than the ultimate segment, not or scarcely immersed in the segment tip, the valves as broad or broader than long, their margins provided with simple or bifurcate trichomes.

This plant could be confused in Guatemala only with *H. sieberi*, but similarity between the two is superficial. Besides the characteristics listed in the key, *H. crassipetiolatum* also differs from *H. sieberi* in that the valves of most indusia are broader than long and are provided with simple to bifurcate trichomes. Most indusia of *H. sieberi* have valves slightly longer than broad, with bifurcate to stellate trichomes.

Specimens of *H. crassipetiolatum* are often found in herbaria misidentified as *H. trapezoidale* Liebm. The latter apparently does not occur in Guatemala, and differs from *H. crassipetiolatum* in that segments are glabrous between veins and margin, petioles are more delicate (less than 0.6 mm. thick) and generally lack stellate trichomes, and the rachis is often nonalate in the lower portion. The rachis in *H. crassipetiolatum* is alate throughout, or is lacking wings just at the base of the blade.

Hymenophyllum crispum HBK. Nov. Gen. & Sp. 1: 26: 1815. *Sphaerocionium crispum* (HBK.) Kl. Linnaea 1: 537: 1844. *Hymenophyllum schiedeanum* v.d. Bosch, Ned. Kruidk. Arch. 4: 414. 1859.

In deep shade, on trees, slopes, and banks of streams and ravines, 1,800-3,000 m.; Quezaltenango; El Quiché; San Marcos. Jamaica; Mexico; Costa Rica; Colombia; Venezuela; Peru; Bolivia; Brazil.

Plants terrestrial or epiphytic; rhizome thin, long-creeping, delicate, sparsely provided with lax, filiform, light brown trichomes; leaves subdistant on the rhizome, determinate, pendent or often forming dense mats, mature ones 4-20 cm. long; petiole delicate, 0.5-3 cm. long, 0.15-0.2 mm. in diameter, inconspicuously alate toward the apex, sparsely pilose, the trichomes mostly simple; lamina linear to narrow-ovate, the lower 1-4 pair of pinnae slightly reduced, leaf surface glabrous between veins and margin; rachis conspicuously alate throughout, the wing undulate to crispate, provided with scattered, simple to stellate trichomes; pinnae deeply pinnatisect, the costae broadly alate; pinna segments 2-5 pairs, simple, or some basal ones bifid, undulate to crispate, entire, trichomes on the margin scattered, mostly simple, those on the veins stellate and scattered abaxially, lacking adaxially; indusium as broad or broader than the ultimate segment, scarcely immersed in the tissue, the valves suborbicular, ovate or elliptic, their margins provided with scattered, simple trichomes.

Hymenophyllum ectocarpon Fée, Mem. Fam. Foug. 11: 115, *t.* 31. *f.* 1. 1866.

On tree trunks in dense forests, 300-1,200 m.; Alta Verapaz; Ixabal. British Honduras; Nicaragua; Costa Rica; Lesser Antilles.

Plants epiphytic; rhizome thin, creeping, sparsely provided with simple, reddish trichomes; leaves subdistant on the rhizome, mature ones 7-15 cm. long; petiole 1-2 cm. long, 0.3-0.4 mm. in diameter, provided with scattered, simple, reddish trichomes, very rarely narrow-alate (though often thin-marginate); lamina of mature leaves 6-13 cm. long, 2.5-4.5 cm. broad, lanceolate to ovate, glabrous except on the major axes, commonly tripinnatifid, not or scarcely narrowed at base, occasionally the proximal 1-2 pairs of pinnae slightly reduced; rachis narrow-alate, or marginate toward the base, the wing plane; pinnae adnate, or the basal pair short-stalked, mostly symmetrical, or sometimes asymmetrical at base (truncate acroscopically, oblique basiscopically); ultimate segments 1-1.8 mm. broad, plane, sharply and deeply serrate throughout, the apices rounded or retuse; sori 1-5 on the acroscopic side of each pinna and often 1-2 (3) on the basiscopic side; indusium somewhat or not at all constricted at the cuneate base, scarcely to partially immersed in the tissue, the valves acute or obtuse, lanceolate to elliptic or obovate, lacinate to subciliate in the apical half; receptacle stout-cylindric or slightly thickened at base.

Hymenophyllum ectocarpon is only provisionally maintained here as a separate species. It appears to differ from *H. fucoides* (at least in Guatemala) merely in the shape and number of indusia. Therefore, positive identification of sterile material is difficult or impossible. Generally, *H. ectocarpon* seems to be a more delicate plant, with petiole a bit shorter and thinner, and the lamina relatively longer and narrower. Also, from Guatemalan collections examined, *H. ectocarpon* apparently prefers lower elevations (300-1,200 m.), while *H. fucoides* is found at 1,250-3,150 m.

Hymenophyllum elegans Sprengel, Syst. Veg. 4: 133. 1827. *H. caudatellum* Christ, Bull. Herb. Boissier II. 4: 939. 1904. *Sphaerocionium elegans* (Sprengel) Copel. Philipp. J. Sci. 67: 32. 1938.

Thus far known from only one collection in Guatemala (*Maxon & Hay 3329*, tree trunk, trail from Senahú to Actalá, Alta Verapaz). Costa Rica; Panama; West Indies; Colombia; Venezuela; Brazil; Peru; Bolivia.

Plants epiphytic; rhizome thin, long-creeping, delicate, sparsely provided with lax, filiform, light brown trichomes; leaves subdistant on the rhizome, determinate, pendent or often somewhat matted, mature ones 5-25 cm. long; petiole delicate, 0.5-2 cm. long, 0.15-0.2 mm. in diameter, nonalate, sparsely pilose with simple or bifid trichomes; lamina commonly linear to linear-lanceolate, rarely ovate, the lowest 1-2 pairs of pinnae slightly reduced, leaf surface glabrous between veins and margin; rachis (at least on mature leaves) alate except near base of lamina, or most pinnae conspicuously decurrent, thus the rachis appearing discontinuously alate, provided with scattered, simple or bifurcate trichomes; pinnae sessile to adnate, pinnatisect (or rarely some segments cut entirely to the costa), often appearing subdigitate; pinna segments 1-2 (3) pairs, simple, or the basal acroscopic one bifid, plane or

slightly undulate, trichomes simple to bifid, scattered to abundant on the margins, rare to lacking on the veins; indusia as broad or broader than the ultimate segments, scarcely or not immersed in the segment tip, the valves suborbicular or elliptic, their margins provided with abundant, mostly simple trichomes.

This and *H. lineare* do not differ significantly. See discussion of the latter for additional comments.

Hymenophyllum elegantulum v.d. Bosch, Ned. Kruidk. Arch. 4: 408. 1859. *H. pulchellum* sensu Hook. Sp. Fil. 1: 91, *pro parte*, and *t.33A*. 1846 (not *H. pulchellum* Schlecht. & Cham. 1830. *Sphaeroclonium elegantulum* (v.d. Bosch) Copel. Philipp. J. Sci. 67: 32. 1938.

Pendent on tree trunks or occasionally on moist, shaded cliffs, in deep forests, 2,400-3,000 m.; Baja Verapaz; Chimaltenango; Huehuetenango; El Progreso; Quezaltenango. Mexico; Honduras; El Salvador; Costa Rica; Panama; Greater Antilles; Venezuela; Colombia to Bolivia.

Plants commonly epiphytic; rhizome filiform, long-creeping, provided with simple, light brown trichomes; leaves distant on the rhizome, indeterminate, pendent, mature ones 8-25 cm. long, 2.5-5 cm. broad; petiole 1.5-4 cm. long, 0.2-0.25 mm. in diameter, nonalate (although basal pinna sometimes short-decurrent), sparsely provided with simple (rarely bifurcate) trichomes; lamina linear to broadly lanceolate, the lower 1-4 pairs of pinnae somewhat or greatly reduced; rachis alate above, nonalate toward the base, rather abundantly stellate-hirsute; pinnae deeply pinnatisect, the costae broadly alate; pinna segments 4-6 pairs, mostly simple, occasionally bifid (or rarely the basal acroscopic ones trifid); ultimate segments plane or slightly undulate, entire, veins and leaf surfaces rather abundantly provided with short-stalked, stellate trichomes; marginal trichomes stellate or bistellate, subsessile to short-stalked; indusium as broad as or slightly narrower than the ultimate segment, not or slightly immersed, the valves usually longer than broad, their margins provided with stalked, stellate trichomes.

This and *H. pulchellum* are sometimes confused in herbaria. Further information may be found under discussion of the latter.

Hymenophyllum fragile (Hedw.) Morton, Contr. U.S. Natl. Herb. 29: 172. 1947. *Trichomanes fragile* Hedw. Fil. Gen. *t.18*. 1802. *Hymenophyllum intercalatum* Christ, Bull. Herb. Boissier II. 4: 942. 1904.

Growing on tree trunks, often in mats (outside Guatemala sometimes reported found on wet, mossy banks), 750-1,150 m.; Alta Verapaz. Mexico; Costa Rica; Panama; Greater Antilles; Colombia; Venezuela; Peru; Bolivia; Brazil.

Plants commonly epiphytic; rhizome filiform, long-creeping, provided with simple, delicate, light brown trichomes; leaves determinate, subdistant on the rhizome, mature ones (in ours) 3-6 cm. long, ca. 1.5 cm. broad; petiole 0.1-1 cm. long (in ours),

0.1-0.2 mm. in diameter, nonalate (although basal pinna sometimes short-decurrent), sparsely to abundantly provided with simple or bifurcate trichomes (or some stellate ones at apex); lamina ovate to linear-lanceolate, scarcely or not reduced at base; rachis broadly alate throughout, rather abundantly provided with sessile, stellate trichomes; pinnae simple to bifid, or rarely some basal ones twice bifid or sublabelate; ultimate segments plane or slightly undulate, entire, veins and leaf surface sparsely to abundantly provided with sessile, stellate trichomes; marginal trichomes sessile or subsessile, stellate, rather abundant; indusium as broad or slightly narrower than the ultimate segment, not or slightly immersed, the valves more or less as long as broad, their margins rather abundantly provided with stalked, stellate trichomes.

From Costa Rica to South America, the species is frequently found at higher elevations (to ca. 2,000 m.) and plants are generally larger than those in Guatemala, with leaves to 15 cm. long, petioles to 2.5 cm. long, and pinnae more commonly once or twice bifid.

Hymenophyllum fucoides (Sw.) Sw. J. Bot. (Schrader) 1800 (2): 99. 1801. *Trichomanes fucoides* Sw. Prodr. 136. 1788. *Hymenophyllum spinulosum* HBK. Nov. Gen. & Sp. Pl. 1: 26. 1815. *Leptocodium fucoides* (Sw.) Presl, Hymenoph. 27. 1843.

On tree trunks in dense forests, 1,250-3,150 m.; Alta Verapaz; Chimaltenango; Huehuetenango; Jalapa; Quezaltenango; El Quiché; Zacapa. Southern Mexico; Honduras to Panama; West Indies; Colombia and Venezuela to Brazil and Bolivia.

Plants epiphytic; rhizome thin, creeping, sparsely provided with simple, reddish trichomes; leaves subdistant on the rhizome; mature ones 8-20 cm. long; petiole 1.5-4 cm. long, 0.4-0.7 mm. in diameter, provided with scattered, simple, reddish trichomes, nonalate (although often thin-marginate); lamina of mature leaves 7-17 cm. long, 1.5-5 cm. broad, ovate to linear-lanceolate, glabrous except on the major axes, commonly tripinnatifid, somewhat narrowed at base, the lower 1-5 pairs of pinnae slightly reduced; rachis narrow-alate, or marginate toward the base, the wing plane; pinnae adnate, or the proximal 1-3 pairs short-stalked, mostly symmetrical, or sometimes asymmetrical at base (truncate acroscopically, oblique basiscopically); ultimate segments 1-1.8 mm. broad, plane, sharply and deeply serrate throughout, the apices rounded or somewhat retuse; sori 1-2 per pinna, borne acroscopically on the basal pinnules (very rarely a single sorus may be borne basiscopically); indusium strongly constricted at base, almost appearing short-stalked, not (or rarely slightly) immersed in the tissue, the valves acute or obtuse, lanceolate to elliptic or obovate, entire or serrulate near the apex; receptacle thickened to narrow-turbinate, slightly to greatly exserted at maturity.

This and other species of section *Ptychophyllum* are in need of further study. As Morton suggested, *H. fucoides* may well be an aggregate species; and one of the components is most certainly *H. ectocarpon*, under which see additional comments.

Hymenophyllum hirsutum (L.) Sw. J. Bot. (Schrader) 1800 (2): 99. 1801. *Trichomanes hirsutum* L. Sp. Pl. 1098. 1753. *T. ciliatum* Sw. Prodr. Veg. Ind. Occ. 136. 1788. *Hymenophyllum ciliatum* (Sw.) Sw. J. Bot. (Schrader) 1800 (2). 100. 1801. *Sphaerocionium ciliatum* (Sw.) Presl, Hymenoph. 34. 1843. *S. hirsutum* (L.) Presl, loc. cit. *H. microcarpum* Fée, Crypt. Vasc. Bres. 1: 245. 1869 (not *H. microcarpum* Desv. 1827).

In deep shade, pendent from tree trunks, or growing on moist banks or rotting logs in wet forests, 150-1,800 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Huehuetenango; Izabal; Petén; El Quiché. West Indies; southern Mexico; Honduras; Nicaragua; Costa Rica; Colombia to the Guianas, south to Bolivia and Brazil.

Plants epiphytic or terrestrial; rhizome thin, wiry, long-creeping, provided with simple, reddish to light brown trichomes; leaves subdistant on the rhizome, determinate, pendent or spreading, mature ones 3-12 cm. long; petiole 0.5-2.5 cm. long, 0.2-0.3 (0.4) mm. in diameter, alate one-half to three-quarters to base, abundantly provided with bifurcate to (mostly) stellate trichomes; lamina ovate to oblong, the lower 2-3 pairs of pinnae somewhat to greatly reduced, leaf surface glabrous between veins and margin; rachis conspicuously alate throughout, the wings plane to slightly crispate, abundantly provided with bifurcate to (mostly) stellate trichomes; pinnae deeply pinnatifid, the costae broadly alate; pinna segments 2-5 pairs, simple, or some basal ones bifid, plane to very slightly undulate, entire, marginal trichomes abundant, bifurcate or stellate, those of the veins mostly stellate on both sides; indusium about as broad as the ultimate segment, not or scarcely immersed in the segment tip, the valves suborbicular, their margins abundantly provided with simple to bifurcate trichomes.

This is easily confused with *H. maxonii*, under which see further discussion.

Hymenophyllum lanatum Fée, Mem. Fam. Foug. 11: 116. 1866. *Sphaerocionium lanatum* Copel. Philipp. J. Sci. 67: 31. 1938.

Growing on tree trunks or large, mossy logs, often in dense mats, 900-1,500 m.; Alta Verapaz; Baja Verapaz; Huehuetenango. West Indies; Surinam; Venezuela(?).

Plants commonly epiphytic; rhizome filiform, long-creeping, provided with simple, delicate, yellow-brown trichomes; leaves determinate, subdistant on the rhizome, mature ones 2-5 cm. long (in ours), 1-1.5 cm. broad; petiole 0.5-3 cm. long, 0.1-0.15 mm. in diameter, nonalate, sparsely provided with stalked, stellate trichomes; lamina ovate to lanceolate, scarcely or not reduced at base, divided nearly to the rachis into linear segments; rachis broadly alate throughout, rather abundantly provided with short-stalked, stellate trichomes; primary segments simple, or rarely some basal ones bifid, essentially plane, entire, veins and leaf surface abundantly provided with short-stalked, stellate trichomes; marginal trichomes stellate or bistellate, obviously stalked, rather abundant; indusium slightly narrower than the

segments, not or slightly immersed, the valves about as long as broad, their margins rather abundantly provided with stalked, stellate trichomes.

Hymenophyllum lineare (Sw.) Sw. J. Bot. (Schrader) 1800 (2): 100. 1801. *Trichomanes lineare* Sw. Prodr. Veg. Ind. Occ. 137. 1788. *Didymoglossum lineare* (Sw.) Desv. Mem. Soc. Linn. Paris 6: 331. 1827. *Sphaerocionium lineare* (Sw.) Presl, Hymenoph. 34. 1843. *Hymenophyllum elegantissimum* Fée, Mém. Fam. Foug. 11: 118. 1866.

In shade, on tree trunks, 600-1,200 m.; Alta Verapaz; Baja Verapaz. Costa Rica; West Indies.

Plants epiphytic; rhizome thin, long-creeping, delicate, sparsely provided with lax, filiform light brown, mostly simple trichomes; leaves commonly pendent, mature ones 5-15 cm. long; petiole delicate, 0.5-3 cm. long, 0.15-0.2 mm. in diameter, nonalate, sparsely pilose with simple or bifurcate trichomes; lamina commonly ovate or narrow-oblong, the lowest 2-3 pairs of pinnae slightly reduced, leaf surface glabrous between veins and margin; rachis nonalate in proximal half, or often nearly to apex, provided with scattered, simple to bifurcate trichomes; pinnae mostly adnate to sessile, or several lower pairs short-stalked, deeply pinnatisect (or some basal segments cut entirely to costa), the costa commonly alate throughout (often very narrowly so); pinna segments 3-5 pairs, simple to bifid, plane or slightly undulate, trichomes simple or forked at base, scattered on the margins, rare or lacking on the veins on both sides; indusia commonly much broader than the ultimate segments (often conspicuously so), not or rarely immersed in the segment tip, the valves suborbicular to elliptic, their margins provided with scattered, simple trichomes.

Besides the characters noted in the key, *Hymenophyllum lineare* often differs from *H. elegans* in the shape of the mature leaf, that of the former mostly broader and ovate, and that of the latter much narrower. However, the two may be merely ecological variants, the few distinctions perhaps resulting from the exposed or protected, dry or wet habitat in which the individual occurs. All their apparent differences are due to constriction of tissue. Thus, in *H. lineare* segments and wings are so narrow that the pinnae often appear elongated and skeletal, and the indusia conspicuously broader, (a parallel condition occurs in two closely related species of *Trichomanes*: *T. capillaceum* and *T. angustatum*).

Neither *H. lineare* nor *H. elegans* are adequately represented in herbaria. It is hoped that additional collections, more careful observations, and better field notes will further establish the proper relationship of these species in the future.

Hymenophyllum maxonii Christ ex Morton, Contr. U.S. Natl. Herb. 29: 165. 1947. *Sphaerocionium maxonii* (Christ ex Morton)

Pic. Ser. Webbia 28: 471. 1973. *H. maxonii* var. *angustius* Morton, Contr. U.S. Natl. Herb. 29: 166. 1947.

In deep shade, on tree trunks, in forests or wooded ravines, 1,000-2,000 m.; Alta Verapaz (type collection: on trail from Senahú to Acatlá, *Maxon & Hay 3326*); Baja Verapaz; Chiquimula; Huehuetenango.

Plants epiphytic; rhizome thin, wiry, long-creeping, provided with simple, reddish trichomes; leaves subdistant on the rhizome, determinate, commonly pendent, mature ones 6-30 cm. long; petiole 2.5-7 (10) cm. long, (0.2) 0.3-0.5 mm. in diameter, rather conspicuously alate at the apex or, rarely, along the upper third, the wing abruptly terminating, provided with simple to bifurcate trichomes; lamina ovate to oblong, the lower 2-3 pairs of pinnae somewhat to greatly reduced, the leaf surface glabrous between veins and margin; rachis conspicuously alate throughout, the wings plane to slightly crispate, abundantly provided with simple or bifurcate (rarely stellate) trichomes; pinnae deeply pinnatifid, the costae broadly alate; pinna segments simple to bifid, the basal acroscopic ones often again bifid, plane to slightly undulate, entire, marginal trichomes abundant, bifurcate or stellate, those on the veins mostly stellate on both sides; indusium about as broad as the ultimate segment, not or scarcely immersed in the segment tip, the valves suborbicular, their margins abundantly provided with simple to bifurcate trichomes.

Morton further recognized var. *angustius* from Alta Verapaz, presumably differing from the typical *H. maxonii* in its longer and relatively narrower leaves.

There are few significant differences between *H. maxonii* and *H. hirsutum*. Perhaps *H. maxonii* may be nothing more than a more luxuriant variety of the latter, having somewhat more complex pinnae, with blade and petiole longer, but with a comparatively shorter petiole wing. *H. hirsutum* apparently has petioles with predominantly stellate trichomes, while those of *H. maxonii* are simple to bifurcate. However, the stellate trichomes are evidently produced from the wing (rather than from the petiole itself), thus *H. hirsutum*, having a much greater percentage of the petiole alate, has an abundance of stellate trichomes. Conversely, the petiole of *H. maxonii* appears predominantly simple-hirsute, since only the abbreviated wing near the apex has stellate trichomes.

Hymenophyllum microcarpum Desv. Mem. Soc. Linn. Paris 6: 333. 1827 (not *H. microcarpon* Fée, 1869). *H. angustifrons* Christ, Bull. Herb. Boissier II. 4: 940. 1904. *Mecodium microcarpum* (Desv.) Copel. Philipp. J. Sci. 67: 25. 1938. *Sphaerocionium microcarpum* (Desv.) Copel. *tom. cit.* 34.

In deep shade, commonly on tree trunks, in forests or wooded ravines, 900-2,600 m.; Alta Verapaz; Baja Verapaz; Huehuetenango.

go; Jutiapa; Zacapa. Honduras and El Salvador to Panama; Greater Antilles; Colombia to the Guianas, southward to Brazil and Bolivia.

Plants commonly epiphytic; rhizome wiry, long-creeping, rather densely provided with simple, light brown or reddish trichomes; leaves distant, determinate, mature ones 10-30 cm. long, petiole 3-9 (12) cm. long, 0.5-0.9 mm. in diameter, rather conspicuously alate for nearly half its length, sparsely to abundantly provided with stellate trichomes, or glabrescent; lamina ovate or broadly lanceolate, only the basal pair of pinnae scarcely (or not at all) reduced, leaf surface glabrous between veins and margin; rachis conspicuously alate throughout, the wing undulate to crispate, sparsely to abundantly provided with stellate trichomes; pinnae deeply pinnatisect, the costae broadly alate; pinnules 4-8 pairs, deeply pinnatifid; ultimate segments linear, plane or somewhat undulate, entire, trichomes on the margin scattered, mostly simple, or once-forked at base, those on the veins stellate and scattered abaxially, lacking adaxially; indusia commonly much broader than the ultimate segments, not immersed in the tissue, the valves ovate or elliptic, their margins provided with scattered, simple trichomes.

Hymenophyllum myriocarpum Hook. Sp. Fil. 1: 106. 1844. *Sphaerocionium myriocarpum* (Hook.) Kl., Linnaea 18: 536. 1844. *Mecodium myriocarpum* (Hook.) Copel. Philipp. J. Sci. 67: 25. 1938.

On tree trunks and branches, in forests, from sea level to 2,800 m.; Alta Verapaz; Baja Verapaz; Chimaltenango; Chiquimula; Izabal; San Marcos; Sololá. Mexico; Honduras; El Salvador; Costa Rica; Colombia and Venezuela to Bolivia.

Plants epiphytic; rhizome thin, creeping, provided with scattered, simple, reddish trichomes; leaves subdistant on the rhizome, mature ones 10-25 (30) cm. long; petioles 1.5-4 (5) cm. long and 0.3-0.7 mm. in diameter, provided with scattered, simple, reddish trichomes or glabrescent, marginate or alate partly or fully to base (often deciduous); lamina of mature leaves 8-21 (24) cm. long, 1.5-3.5 cm. broad, commonly 4-7 times as long as the petiole, glabrous throughout, 2- to 3-pinnatifid, gradually narrowed at base, the lower 3-5 pairs of pinnae somewhat to greatly reduced; rachis alate or marginate throughout, the wing plane to undulate or revolute (occasionally somewhat crispate); pinnae numerous, adnate; ultimate segments 1 mm. broad or less, entire, plane to undulate; sori one to several on most pinnules; indusia much broader than the greatly constricted segment tips, thus appearing stalked, the valves mostly suborbicular or broadly ovate; receptacle narrow-cylindric, short to rudimentary.

This is a highly problematical species, perhaps synonymous with *H. polyanthos*. For further information, see discussion of the latter.

Hymenophyllum polyanthos (Sw.) Sw. J. Bot. (Schrader) 1800 (2): 102. 1801. *Trichomanes polyanthos* Sw. Prodr. 137. 1788. *Mecodium polyanthos* (Sw.) Copel. Philipp. J. Sci. 67: 19. 1938.

On trunks and branches of trees, and on fallen logs, occasionally reported on clay banks, in deep forests, from sea level to 3,100 m.; Alta Verapaz; Baja Verapaz; Chimaltenango; Chiquimula; Escuintla; Guatemala; Huehuetenango; Izabal; Jalapa; El Progreso; El Quiché; San Marcos; Sololá; Suchitepéquez; Zacapa. Mexico to Panama; West Indies; South America; Old World tropics and subtropics.

Plants commonly epiphytic; rhizome thin, creeping, provided with scattered, simple, reddish trichomes; leaves subdistant on the rhizome, mature ones 7-17 cm. long; petiole 2-5 cm. long and 0.3-0.7 mm. in diameter, provided with scattered, simple, reddish trichomes or glabrescent, nonalate, or more commonly marginate or alate partly or fully to base (wings often deciduous); lamina of mature leaves 5-12 cm. long, 2-6 cm. broad, about 1.5-3.5 times as long as the petiole, glabrous throughout, 2- to 3-pinnatifid, not or scarcely reduced at base; rachis alate or marginate throughout, the wing plane to undulate or revolute (rarely somewhat crispate); pinnae several to many pairs, adnate, or the lower one short-stalked; ultimate segments 1 mm. broad or less, entire, plane to undulate, or rarely slightly crisped; sori often several on each pinnule; indusium narrower to slightly broader than the segment tips, the valves mostly ovate to elliptic, somewhat immersed in the tissue; receptacle narrow-cylindric, short or rudimentary.

This is a highly variable species, one of the most widely distributed ferns of tropical regions throughout the world, which ranges in altitude from sea level to the montane forests. It is a member of the subgenus *Mecodium*, whose species are characterized by entire segments and glabrous laminae. This very lack of pubescence, coupled with the sameness of leaf margins, renders it a taxonomically difficult group. Although Copeland studied the species as it occurs in parts of the Old World, very little work has been done with it in the neotropics; consequently the relationship with its New World allies is not well understood. Monographic work may reveal that dozens of so-called "species" in tropical America are but synonyms of *H. polyanthos*, as Copeland discovered in the Old World. One of these may be the Guatemalan *H. myriocarpum*, which is distinguished primarily by leaf shape, a characteristic notably variable throughout the Hymenophyllaceae. The differences listed in the key are mostly quantitative and may be nothing more than products of varying habitats or availability of moisture.

Hymenophyllum pulchellum Schlecht. & Cham. Linnaea 5: 618. 1830. *Sphaerocionium pulchellum* (Schecht. & Cham.) Presl, Hymenoph. 34. 1843. *H. pannosum* Christ, Bull. Herb. Boissier II. 5: 250. 1905.

In shade, in or at edges of forests or in wooded ravines, pendent from logs, tree trunks, or rocky banks, 250-2,500 m.; Alta Verapaz; Baja Verapaz; San Marcos; Sololá; Suchitepéquez. Southern Mexico; British Honduras; Honduras; Costa Rica; southeastern Brazil.

Plants terrestrial or epiphytic; rhizome thin, long-creeping, delicate, sparsely provided with lax, filiform, light brown or reddish trichomes; leaves subdistant on the rhizome, indeterminate, commonly pendent, mature ones 6-30 cm. long; petiole delicate, 2.5-4 cm. long, 0.2-0.3 mm. in diameter, nonalate, sparsely provided with simple to stellate trichomes; lamina linear to oblong, the lower 2-6 pairs of pinnae often greatly reduced, leaf surfaces glabrous between veins and margins; rachis nonalate except near apex, sparsely to abundantly provided with stellate trichomes; pinnae mostly short-stalked, deeply pinnatifid, the costa continuously alate on both sides; pinna segments 4-8 pairs, simple, or some basal ones bifid, plane or slightly undulate, entire, trichomes on the margin and veins abundant, sessile, stellate; indusium about as broad as or narrower than the ultimate segment, scarcely immersed in the tissue, the valves suborbicular or hemispherical, their margins abundantly provided with stellate trichomes.

Trichomes on the margins and veins in this species are often so dense and long that they appear to spring from the intervening tissue as well. Consequently, specimens of *H. pulchellum* are sometimes found in herbaria filed with species of subsection *Hirsuta* usually determined as *H. elegantulum*. Trichomes on the latter, however, are rarely as densely crowded, and their points of attachment on the laminar surface are generally quite obvious. Moreover, most of the trichomes on the segment margins of *H. elegantulum* are short-stalked, whereas those of *H. pulchellum* are commonly sessile.

Hymenophyllum sieberi (Presl) v.d. Bosch, Ned. Kruidk. Arch. 4: 414. 1859. *Sphaerocionium sieberi* Presl, Hymenoph. 58. 1843. *Hymenophyllum wercklei* Christ, Bull. Herb. Boissier II. 4: 940. 1904. *Sphaerocionium wercklei* (Christ) Copel. Philipp. J. Sci. 67: 31. 1938.

Pendent from tree trunks and branches, or on mossy logs, in and at edges of dense forests, 950-1,600 m.; Alta Verapaz; Huehuetenango. Mexico (Chiapas) to Costa Rica; Puerto Rico; Guadeloupe; Martinique.

Plants commonly epiphytic; rhizome wiry, long-creeping, provided with simple, reddish or light brown trichomes; leaves subdistant on the rhizome, indeterminate, pendent, mature ones 15-60 cm. long, 3-6.5 (10) cm. broad; petiole 1.5-5.5 (7) cm. long, 0.3-0.5 mm. in diameter, broadly alate near the apex, and often narrowly alate along the apical half, sparsely to abundantly provided with furcate or stalked, stellate trichomes; lamina ovate or, more commonly, linear-lanceolate, gradually but distinctly reduced at base, the lower 4-10 pairs of pinnae much shorter; rachis

broadly alate throughout (but the wing sometimes fugacious at base of lamina), the wings plane to slightly crispate, sparsely or abundantly provided with subsessile or stalked, stellate trichomes; pinnae shallowly or deeply pinnatifid, the costae broadly alate, pinna segments 3-7 pairs, simple to bifid, or rarely some larger basal ones twice bifid or subflabellate; ultimate segments plane or slightly undulate, entire, veins and leaf surface sparsely to abundantly provided with subsessile or stalked, stellate trichomes; marginal trichomes stalked, stellate, the 3-4 delicate rays commonly spreading; indusium as broad or broader than the ultimate segment, not or scarcely immersed in the segment tip, the valves usually somewhat longer than broad, their margins provided with bifurcate or stalked, stellate trichomes.

This may be confused in Guatemala with *H. crassipetiolatum*, under which see further discussion. The two are part of a very closely knit species complex which includes *H. plumieri* Hook. & Grev., *H. lindenii* Hook. and *H. interruptum* Kunze of South America.

Hymenophyllum tricophyllum HBK. Nov. Gen. & Sp. 1: 27. 1815.
Sphaerocionium tricophyllum (HBK.) Copel. Philipp. J. Sci. 67: 32. 1938.

In shade, growing in dense, tangled mats, commonly on tree trunks, but (especially in Guatemala) often on moist, clay banks. 2,000-3,200 m.; Zacapa. Costa Rica; Panama; Colombia; Venezuela; Ecuador; Bolivia.

Plants terrestrial or (outside Guatemala) more commonly epiphytic; rhizome thin, long-creeping, delicate, sparsely provided with lax, filiform, light brown or reddish trichomes; leaves subdistant on the rhizome, indeterminate, mature ones 3-12 cm. long; petiole delicate, 0.5-3 cm. long, 0.1-0.2 mm. in diameter, nonalate, provided with widely scattered, simple or bifurcate trichomes; lamina commonly linear, the two lower pairs of pinnae scarcely reduced, leaf surfaces glabrous between veins and margin; rachis nonalate throughout, provided with widely scattered, simple or bifurcate trichomes; pinnae mostly short-stalked, pinnate, the costa not continuously alate on both sides, or some of them greatly elongated, often becoming frond-like, much exceeding adjacent ones; ultimate segments linear, plane or slightly undulate, entire, trichomes on the margins and veins abundant, stellate; indusium about as broad as or narrower than the ultimate segment, scarcely immersed in the tissue, the valves suborbicular to hemispherical, their margins abundantly provided with stellate trichomes.

This is perhaps the most delicate and certainly the most peculiar species in section *Sphaerocionium*. The filiform petioles and rachises entwine with adjacent leaves, often forming dense mats on banks or tree trunks. Occasionally, one pinna becomes greatly elongated and once again pinnate-pinnatifid, and then often equals the length of the leaf on which it is borne.

Hymenophyllum undulatum Sw. J. Bot. (Schrader) 1800 (2): 101. 1800. *Trichomanes undulatum* Sw. Prodr. 137. 1788 (not *T. undu-*

latum Wall. 1828, nor *T. undulatum* v.d. Bosch. 1861). *Sphaerocionium undulatum* (Sw.) Presl, Hymenoph. 35. 1843. *Mecodium undulatum* (Sw.) Copel. Philipp. J. Sci. 67: 26. 1938.

Pendent from tree trunks, or on wet banks or mossy rocks, in forests, 1,200-2,600 m.; Alta Verapaz; Baja Verapaz (?); Guatemala; Zacapa. Southern Mexico; Honduras; Costa Rica; Panama; Greater Antilles; Colombia; Ecuador; Brazil.

Plants usually epiphytic; rhizome thin, delicate, creeping, provided with scattered, simple, reddish trichomes; leaves subdistant on the rhizome, mature ones 7-35 cm. long; petiole 2-4.5 cm. long, 0.1-0.2 mm. in diameter, provided at base with a few simple, reddish trichomes or glabrescent, nonalate; lamina of mature leaves 8-30 cm. long, 1-3 cm. broad, glabrous throughout, 2- to 3-pinnatifid, gradually narrowed to the base, the lower 2 to many pinnae somewhat to greatly reduced; rachis marginate or narrow-alate in the distal one-half to two-thirds of the lamina (often narrow-alate on alternate sides due to the decurrent pinna bases), the wing plane or undulate; pinnae numerous, adnate, or long-decurrent, or one or several proximal ones short-stalked; ultimate segments 1 mm. broad or less, entire, slightly to strongly undulate; sori several and terminal or lateral on each pinna; indusia narrower to much broader than the segments, the valves suborbicular, ovate or elliptic, slightly or not at all immersed at the cuneate or truncate base; receptacle narrow-cylindric, short or rudimentary.

Perhaps *H. contortum* should be included here. See further discussion under that species.

TRICHOMANES Linnaeus

Reference: J. G. Wessels Boer, The New World species of *Trichomanes* sect. *Didymoglossum* and *Microgonium*, Acta Bot. Neerl. 11: 277-330. 1962.

Plants epiphytic or terrestrial, occasionally saxicolous; rhizome sparsely to densely provided with brown or blackish trichomes, stout, ascending to erect with leaves fasciculate, or (more commonly) thin, delicate and long-creeping with leaves widely spaced; leaves monomorphic, or rarely dimorphic, simple to several times pinnate, 0.5-80 cm. long (in ours), subsessile to long-petiolate; petiole delicate to wiry, flattened, terete, or occasionally rounded-trigonal, in a few species sulcate on the adaxial side, commonly shorter than the lamina and often alate for all or part of its length; lamina suborbicular to lanceolate to subdeltoïd, glabrous, glandular or hirsute, the trichomes simple, bifid or sessile-stellate; venation pinnate (catadromous or anadromous) or flabellate, the true veins free or (rarely) reticulate near the margin, spurious veins often present, mostly parallel, but in some species perpendicular, to the true veins; ultimate segments narrow, often linear to filiform, commonly entire, obtuse, truncate or emarginate at the apex; indusium fully, partly or not at all immersed in the tissue, tubular, narrow-cylindrical to salverform, with an entire or bilabiate mouth which is often widely flaring; receptacle filiform, commonly long-exserted from the indusium at maturity; spores tetrahedral to subglobose, trilete, spinose, tuberculate, or nearly smooth, white or, more commonly, greenish.

There are 250-300 species in the genus, occurring in tropical to subtropical regions of both hemispheres. They are typically found in deep, wet forests, on trees or on the forest floor, on clay banks of ravines and beside streams and waterfalls; some may grow on moist, rocky cliffs or even on wet rocks in streams. Many are pendent from branches, while a few of those with minute leaves are so tightly clustered as to form dense mats on tree trunks.

Of the 24 species treated here, 23 have been collected in Guatemala and another, *T. ekmanii*, has been found in British Honduras. It may be presumed that *T. ekmanii* and other minute species will be found in the future not only in additional locations in Guatemala, but in other tropical American regions as well. Such inconspicuous ferns undoubtedly have been overlooked by collectors in many areas; thus current distribution records are probably far from complete.

- a. Leaves strongly dimorphous, fertile laminae subentire, narrow and spikelike, sterile ones pinnatisect *T. diversifrons*.
- a. Leaves essentially monomorphic, fertile ones often somewhat longer than the sterile, but similar in outline.
- b. Leaves sub-bipinnate to 4-pinnate; venation anadromous.
 - c. Mature leaf 16-50 cm. long; rhizome stout, 1 mm. or more in diameter.
 - d. Rhizome erect or ascending (rarely short-creeping); leaves approximate or subcaespitose *T. rigidum*.
 - d. Rhizome long-creeping; leaves distant.
 - e. Indusium obviously bilabiate, lips widely flaring; petiole broadly alate usually to base. *T. collarium*.
 - e. Indusium scarcely bilabiate, mouth rarely or never flaring; petiole not alate, or only slightly so just below the basal pinnae. *T. radicans*.
 - c. Mature leaf 2.5-15 cm. long; rhizome delicate, 0.2-0.5 mm. in diameter.
 - f. Tissue of *most* ultimate segments with elongate, narrow folds parallel to the veins; tube of the indusium nearly as broad as long. . . . *T. pyxidiferum*.
 - f. Tissue of segments essentially plane; tube of the indusium 2 or more times as long as broad.
 - g. Rachis alate throughout (in *T. hymenophylloides* sometimes obscurely so).
 - h. Petiole alate nearly or quite to the base; rachis broadly alate, with each wing about as broad as the rachis *T. diaphanum*.
 - h. Petiole nonalate, or (rarely) alate just at the apex; rachis narrow-alate, with each wing much narrower than the rachis *T. hymenophylloides*.
 - g. Rachis nonalate for most of its length.
 - i. Ultimate segments 0.5-1 mm. broad; costae alate except at their very base *T. angustatum*.
 - i. Ultimate segments 0.1-0.4 mm. broad; costae of larger pinnae commonly nonalate at least in the proximal third *T. capillaceum*.
- b. Leaves simple to pinnate-pinnatifid; venation catadromous or flabellate.

- j. Mouth of indusium deeply divided into two prominent lips, these commonly dark-margined.
- k. Venation pinnate, with midrib distinct at least in lower half of lamina; lamina of mature leaf commonly 1-9 cm. long.
 - l. Sori mostly to fully immersed in the tissue, or at least flanked on either side by a wing of tissue; spurious veinlets frequently parallel to and very near the margin. *T. krausii*.
 - l. Sori not or scarcely immersed in the tissue; spurious veinlets rarely, if ever, parallel to and near the margin.
 - m. Lips of the indusium mostly broader than long; spurious veinlets rather sparse. *T. hymenoides*.
 - m. Lips of the indusium mostly as long as or longer than broad; spurious veinlets abundant. *T. reptans*.
- k. Venation flabellate, with lamina commonly lacking a distinct midrib; or, when venation sometimes pinnate (in *T. ovale*), lamina of mature leaf 0.5-0.8 cm. long.
 - n. Fertile leaves 0.5-0.8 cm. long and frequently with distinct midrib; sorus solitary at lamina apex *T. ovale*.
 - n. Fertile leaves 1-3 cm. long and lacking distinct midrib; sori (1-) several to many.
 - o. Sori borne between the lobes, rarely exerted much beyond the outline circumscribed by lobe apices; lips of the indusium widely flaring *T. punctatum* ssp. *sphenoides*.
 - o. Sori not borne between lobes, but conspicuously exerted from the lamina; lips of the indusium scarcely or not at all flaring *T. curtii*.
- j. Mouth of indusium not (or scarcely) bilabiate, not dark-margined.
 - p. Margin of lamina bearing paired, orbicular scales. *T. membranaceum*.
 - p. Margin of lamina glabrous or bearing simple to stellate trichomes.
 - q. Spurious veinlets scattered to numerous, parallel or perpendicular to the true veins.
 - r. Leaves simple or lobed, mature ones 1-3 cm. long.
 - s. Leaves with an uninterrupted, spurious vein submarginal along the perimeter of the lamina; marginal trichomes lacking.
 - t. Spurious veinlets numerous, both parallel and perpendicular to true veins, the venation apparently reticulate *T. godmanii*.
 - t. Spurious veinlets scattered, none perpendicular to true veins *T. ekmanii*.
 - s. Leaves without an uninterrupted, submarginal spurious vein; marginal trichomes present, mostly stellate *T. petersii*.
 - r. Leaves pinnate or pinnatisect, mature ones commonly 5-70 cm. long.
 - u. Leaves subcaespitose, long-petiolate; spurious veinlets numerous throughout each pinna, perpendicular to true veins *T. pinnatum*.
 - u. Leaves distant, subsessile; spurious veinlets few, near the margin, parallel to true veins. *T. tuerckheimii*.
 - q. Spurious veinlets absent.
 - v. Leaves lobed or pinnatifid; rhizome thin, horizontal and long-creeping; trichomes on the lamina stellate *T. polypodioides*.

- v. Leaves pinnate or pinnatisect; rhizome stout, suberect or ascending; trichomes on the lamina simple, septate, with the basal cell much shortened and broadened.
- w. Petiole broadly alate halfway or more to the rhizome; rachis broadly alate, with each wing as wide or wider than the rachis; mouth of the indusium rarely wide-flaring *T. galeottii*.
- w. Petiole nonalate, or narrow-alate only at base of blade; rachis (at least the lower half) narrow-alate, with each wing narrower than the rachis; mouth of the indusium often widely flaring *T. crispum*.

Trichomanes angustatum Carm. Trans. Linn. Soc. 12: 513. 1818.
T. tenerum Sprengel, Syst. Veg. 4: 129. 1827. *T. schiedeanum* Fée, Crypt. Vasc. Bres. 1: 188. 1869 (not *T. schiedeanum* K. Müll. 1854).
Vandenboschia tenera (Sprengel) Copel. Phillip. J. Sci. 67: 53. 1938.
V. angustata (Carm.) Copel. *op. cit.* 73: 466. 1941.

In deep shade, on tree trunks or rocky cliffs or banks of ravines, 1,950-3,300 m.; Chimaltenango; El Progreso; Sacatepéquez; San Marcos. Greater Antilles; Colombia; Brazil; Bolivia; Tristan d'Acunha.

Plants terrestrial or epiphytic; rhizome thin, long-creeping, delicate, sparsely to abundantly provided with light or dark brown, flattened trichomes; leaves monomorphic, essentially glabrous, subdistant, but commonly forming dense mats, mature ones 4-12 (16) cm. long and 1.5-5 cm. broad, the laminae much longer than their petioles; petiole 0.5-3 cm. long, terete to somewhat flattened, nonalate, green to stramineous or light brown, usually darker at base; lamina linear-lanceolate, lanceolate or oblanceolate, yellow- to gray-green, thin-membranaceous, translucent, bipinnate-pinnatifid or tripinnate, the lower (2) 3-5 pinnae commonly reduced (often greatly so); rachis nonalate; pinnae 8 to numerous, short-stalked, ascending, crowded or imbricate, costae alate except below the first pinnule; ultimate segments linear, 0.5-0.8 mm. broad, emarginate, lateral margins entire, plane; veins free, anadromous, spurious ones absent; sori 1-4 per pinna, terminating the proximal veinlets, winged on either side by a narrow band of tissue; indusium narrow-funnel-form, the tube 2 or more times as long as broad, the mouth flaring but not bilabiate nor dark-margined; receptacle long-exserted; spores subglobose, densely glandular.

This may be often confused with *Trichomanes capillaceum*, for both species are delicate and have very reduced ultimate segments and nonalate petioles and rachises. Typical *T. capillaceum* appears almost skeletal, with tissue present only on the ultimate segments. However, a number of specimens (at least in Guatemala) have tissue extending along the axes as far down as the distal portion of the costa. Besides the differences noted in the key, *T. angustatum* can frequently be distinguished by the several pairs of greatly reduced pinnae at the base of the lamina, and by its possession of more than one sorus on each pinna. *T. capillaceum* rarely has more than the



FIG. 13. *Trichomanes*. a-b, *T. collariatum*: a, habit, $\times \frac{1}{2}$; b, portion of pinna, $\times 5$; c, *T. radicans*, sori, $\times 5$; d-e, *T. reptans*: d, habit, $\times \frac{1}{2}$; e, apex of lamina, $\times 4$; f, *T. godmanii*, habit, $\times \frac{1}{2}$.

basal pair of pinnae reduced and very rarely more than one sorus on each pinna.

Trichomanes capillaceum L. Sp. Pl. 2: 1099. 1753. *T. trichoideum* Sw. J. Bot. (Schrader) 1800 (2): 98. 1801. *T. tenellum* Hedw. Fil. Gen. & Sp. 1799. *T. schiedeanum* K. Müll. Bot. Zeit. (Berlin) 716. 1854 (not *T. schiedeanum* Fée, 1869). *Vandenboschia capillacea* (L.) Copel. Philipp. J. Sci. 67: 53. 1938.

On trees in forest or on wet, shaded banks of ravines, 300-2,850 m.; Alta Verapaz; Baja Verapaz; El Quiché; Chiquimula; Huehuetenango; Izabal; Quezaltenango; San Marcos; Sololá; Suchitepéquez; Zacapa. Greater Antilles; Southern Mexico; Honduras; El Salvador; Nicaragua; Costa Rica; Panama; Colombia; Venezuela; Ecuador; Peru.

Plants terrestrial or epiphytic; rhizome thin, long-creeping, delicate, sparsely to abundantly provided with light or dark brown, flattened trichomes; leaves monomorphic, essentially glabrous, subdistant, mature ones 5-10 (15) cm. long and 1-5 cm. broad, the laminae usually longer than their petioles; petiole 1-5 cm. long, terete, nonalate, green or drying stramineous, darker at base; lamina lanceolate, ovate or oblanceolate, yellow- or gray-green, thin-membranaceous, translucent, 3- to 4-pinnate, the lower one or two pairs of pinnae somewhat reduced; rachis nonalate; pinnae 6 to numerous, short-stalked, ascending, commonly crowded or imbricate, costae of the larger ones nonalate (at least in the proximal third); ultimate segments filiform, 0.1-0.3 mm. broad, emarginate, lateral margins entire, plane; veins free, anadromous, spurious ones absent; sori commonly 1 per pinna (but rarely as many as 4), terminating the proximal veinlets, mostly stalked and free from the tissue; indusium narrow-funnelform, the tube 2 or more times as long as broad, the mouth flaring but not bilabiate nor dark-margined; receptacle long-exserted; spores subglobose, densely granular.

See also discussion of *Trichomanes angustatum*, a species with which *T. capillaceum* is frequently confused.

Trichomanes collariatum v.d. Bosch, Ned. Kruidk. Arch. 4: 368. 1859. *T. martinezii* Rovir. Pterid. Mex. 106. 1909 (type from Chiapas, Mexico, *Martinez 1103*). *Vandenboschia martinezii* (Rovir.) Pic. Ser., Webbia 28: 472. 1973.

Wet forest and wooded ravines, climbing and often appressed to tree trunks, 50-600 m.; Alta Verapaz; Huehuetenango; Izabal; Petén. Southern Mexico; British Honduras; Honduras; Nicaragua; Costa Rica; Panama; Colombia; Venezuela; Ecuador; Peru; Brazil.

Plants epiphytic; rhizome stout, long-creeping, provided with dark brown, flattened trichomes; leaves monomorphic, distant, 15-40 cm. long, 4-10 cm. broad, subsessile to short-petioled; petiole 0-3 cm. long, stout, terete, yellow- to gray-

brown, broadly alate, commonly with very reduced pinnae at base which overlap the rhizome; lamina linear, lanceolate, or narrow-elliptic, dark green, often drying blackish, firm-membranaceous, opaque, subbipinnate to bipinnate-pinnatifid, subequally reduced at apex and base; rachis with a few, brownish, filiform trichomes, alate throughout and prominently so in lower half; pinnae (on mature leaves) 20-35 pairs, rarely more than 5 cm. long, alternate, sessile to short-stalked, spreading at a broad angle (commonly ca. 90°) from the rachis, oblong or linear-lanceolate to narrow-ovate, essentially glabrous; ultimate segments linear or narrow-oblong, obtuse (sometimes retuse to bifid) plane, margins entire; segments and venation anadromous; veins free, pinnately arranged, strongly ascending, once or twice forked, spurious ones absent; sori often only one per pinnule, and terminating the proximal veinlet, not or scarcely immersed in the tissue; indusium salverform, bilabiate, the lips broad and strongly flaring; receptacle filiform, mostly short-exserted; spores subglobose, tuberculate to spinulate.

This is often confused in herbaria with *Trichomanes radicans*. In addition to the characters noted in the key, the two species usually can be distinguished by blade shape and petiole length. In *T. collariatum* the petiole is rarely more than 3 cm. long and the blade is gradually reduced toward the base, with lower pinnae one-third to one-sixth the length of the central pinnae — a basal pinna frequently crowding or overlapping the rhizome. The petiole of *T. radicans* is commonly 5-12 cm. long, with blade scarcely reduced at base; lower pinnae are about three-fourths the length of the longest central one.

***Trichomanes crispum* L. Sp. Pl. 2: 1097. 1753. *T. cristatum* Kaulf. Enum. Fil. 265. 1824.**

In forests, on tree trunks, wet banks or cliffs, 600-2,500 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Guatemala; Huehuetenango; Santa Rosa; Southern Mexico; Nicaragua; Costa Rica; Panama; West Indies; Trinidad; Colombia; Venezuela; the Guianas; Brazil; Peru; Bolivia; Paraguay.

Plants epiphytic, saxicolous or terrestrial; rhizome stout, horizontal and short-creeping or (in ours) ascending to suberect, provided with dark reddish brown, pluricellular trichomes; leaves monomorphic, subdistant to crowded or (in ours) caespitose, 10-40 cm. long and 2-5 cm. broad; petiole 2.5-12 cm. long, wiry, flattened or (rarely) subtrigonal, gray- or red-brown, nonalate or alate only at base of lamina, abundantly provided with reddish brown, septate trichomes which have the basal cell much shorter and broader than the others; lamina linear, lanceolate or narrow-ovate, dark green or yellowish green, membranaceous, pinnate to pinnatisect, scarcely or not at all reduced at base, narrowed gradually to a pinnatifid apex, the tissue subopaque; rachis in upper half of blade alate, wings lacking in lower half or each one narrower than the rachis, trichomes abundant as on the petiole; pinnae 15 to many pairs, oblong, subopposite to alternate, spreading at nearly right angles from the rachis, subdistant, contiguous or imbricate, obtuse at apex, entire or sinuate, repand or crisped, with yellow or orange trichomes scattered along the costa,

veins and margin, lacking spurious veinlets; veins free, catadromous, 1- to 2-forked, pinnately arranged, spreading obliquely from the costa; sori 2 to 10 at apex of each pinna, fully immersed in the tissue; indusium narrowly cylindric-turbinate or obconic, not bilabiate, the mouth slightly to strongly flaring; receptacle long-exserted; spores tetrahedral to subglobose, somewhat granular to spinulate.

This is a highly variable, rather widespread, species, belonging to section *Achomanes*. When this section is studied in depth, it will probably be determined that a number of species now named in tropical America are conspecific with *Trichomanes crispum*. One of these which occurs in Guatemala is *T. cristatum*, originally described by Kaulfuss as differing from *T. crispum* in leaf size and shape, and in the degree of crisping of pinna margins. However, these are hardly reliable characters in that they vary so greatly on plants throughout the range, even among leaves on the same rhizome, and are therefore a questionable basis for taxonomic distinction. *T. crispum* also varies in other characters; the indusium may be narrow and cylindric to obconic and relatively broad, with mouth slightly to rather strongly flaring; the rhizome may be horizontal and short-creeping with leaves subdistant to rather crowded, or ascending and compact with leaves caespitose. All specimens of *T. crispum* seen from Guatemala have caespitose leaves.

Trichomanes curtii Rosenst. in Fedde, Repert. Spec. Nov. Regni Veg. 22: 5. 1925. *Didymoglossum curtii* (Rosenst.) Pic. Ser. Webbia 28: 469. 1973.

On rocks or tree trunks, sea level to 75 m.; Izabal. British Honduras; Nicaragua, south to Colombia.

Plants saxicolous or epiphytic; rhizome long-creeping, filiform, covered with brown or blackish, mostly flattened trichomes; leaves monomorphic, approximate or widely spaced, to 3 cm. long and 1.5 cm. broad, subsessile, or with petioles to 1 cm. long; lamina suborbicular, ovate or spatulate, base rounded to decurrent, margin entire (on juvenile leaves) or shallowly and irregularly lobed to fissile, essentially plane, yellowish green, a distinct midrib lacking, tissue firm-membranaceous, scarcely or not at all translucent, glabrous except for the stellate, marginal trichomes; veins free, flabellate, very crowded, repeatedly forked, with spurious veinlets scattered parallel to the true veins; sori several to many, partially or scarcely immersed in the tissue, commonly extending conspicuously from the margin (not borne between the lobes); indusium cylindric-turbinate, bilabiate, the lips not (or seldom) flaring, the edges dark-margined; receptacle scarcely to long-exserted; spores tetrahedral to subglobose, spinulate.

Trichomanes curtii may be further distinguished from the closely related *T. punctatum* ssp. *sphenoides* by the opaqueness of the tissue (caused by the densely crowded veins) and by the more numerous (several to many) sori. The tissue of the latter is generally trans-

lucent, with veins much less crowded, and has sori typically numbering two or three.

Trichomanes diaphanum HBK. Nov. Gen. & Sp. 1: 25. 1825. *Vandeboschia diaphana* (HBK.) Copel. Philipp. J. Sci. 67: 53. 1938.

On trees, moist banks and (rarely) wet rocks, in deep forests, 300-3,000 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Quezaltenango; San Marcos; Zacapa. British Honduras; Honduras to Panama; West Indies; Trinidad; Colombia; Venezuela; French Guiana; Brazil; Ecuador; Peru.

Plants terrestrial or, more commonly, epiphytic; rhizome thin, long-creeping, rather delicate, sparsely to abundantly provided with dark brown, flattened trichomes; leaves monomorphic, commonly distant, mature ones 3-15 (18) cm. long and 1-4.5 cm. broad, the blades much longer than their petioles; petiole 1.5-4 cm. long, light or dark brown, flattened, usually alate to base, each wing commonly as broad or broader than the petiole (often partially broken away on herbarium specimens); lamina ovate, yellow- or gray-green, membranaceous, translucent, tripinnate or tripinnate-pinnatifid, scarcely reduced at base, narrowed gradually to a pinnatifid apex; rachis glabrous or obscurely dotted with minute trichomes on abaxial side, broadly alate throughout with each wing about as broad as the rachis; pinnae 6-12 pairs, alternate, short-stalked, obliquely ascending, lanceolate to ovate, tissue glabrous, but axes and veins often with scattered, minute trichomes, costa and costules alate; ultimate segments linear, 0.6-0.9 mm. broad, emarginate, lateral margins entire, the tissue essentially plane; veins free, anadromous, spurious ones absent; sori 1-5 (7) per pinna, terminating the proximal veinlets, both stalk and tube flanked by a rather broad wing of tissue; indusium narrowly funnelform, the tube 2 or more times as long as broad, the mouth flaring but not bilabiate nor dark-margined; receptacle usually long-exserted; spores subglobose, surface densely spinulate.

This and *Trichomanes hymenophylloides* are doubtfully distinct. See further comments under discussion of the latter.

Trichomanes diversifrons (Bory) Mett. in Sadebeck, Nat. Pflanz. 1 (4): 108. 1899. *T. elegans* Rudge, Icon. Pl. Guian. 24. 1805 (not *T. elegans* L.C. Rich. 1792). *Hymenostachys diversifrons* Bory, Dict. Class. Hist. Nat. 8: 462. 1825. *Feea diversifrons* (Bory) Copel. Philipp. J. Sci. 67: 74. 1938.

On moist, wooded slopes and ravines, and along shaded stream and river banks, sea level to 500 m.; Alta Verapaz; Izabal. British Honduras; Honduras; Nicaragua; Costa Rica; Panama; southward to Brazil and Bolivia.

Plants terrestrial; rhizome stout, erect, provided with lustrous, dark brown to blackish, terete or somewhat flattened trichomes which are commonly in dense tufts at rhizome apex; leaves dimorphous, approximate or subcaespitose, the fertile ones far exceeding the sterile and with much longer petioles; sterile leaf to 28 cm. long

and 7 cm. broad, petiole 2-8 cm. long, stout to wiry, terete or slightly flattened, yellowish to greenish or brown, commonly narrow-alate (at least toward the apex), with scattered, dark brown trichomes which extend up the abaxial side of the rachis; sterile lamina lanceolate, yellow- or gray-green, chartaceous, deeply pinnatisect, narrowing at the base and the pinnatifid apex, the rachis frequently prolonged, flagellate and proliferous at the tip, tissue glabrous; pinnae numerous, spreading, acute or subacute, margins serrulate, cut nearly to the rachis, with sinuses narrow and acute; veins pinnately arranged, oblique, once- or twice-forked, arising from rachis as well as costae, free or anastomosing toward pinna margin, spurious ones absent; fertile leaf to 40 cm. long and 0.7 cm. broad, petiole 12-20 cm. long; fertile lamina simple, linear, with sori arranged in a nearly continuous line along each margin, completely immersed in tissue at the forks of veins; receptacle scarcely to slightly exserted; spores subglobose, tuberculate.

The erect, spikelike, fertile blades of this species are borne on elongate petioles far above the cluster of pinnatisect, sterile blades. In this character alone *Trichomanes diversifrons* may be easily distinguished from all other species in Guatemala.

***Trichomanes ekmanii* W. Boer, Acta Bot. Neerl. 11: 319. 1962.**

In our area known only from Middlesex, British Honduras, growing on decayed tree trunks in forest, elev. 60 m., *W. A. Schipp* 324. Honduras; Costa Rica; Panama; Greater Antilles; Colombia; Venezuela; Brazil; Peru; Bolivia.

Plants epiphytic; rhizome long-creeping, filiform, sparsely to densely provided with flattened, brown trichomes which often extend up the petiole; leaves monomorphous, rather widely spaced, 0.5-3 cm. long, 0.5-1.5 cm. broad, subsessile or short-petiolate; petiole 1-5 mm. long, subterete or flattened; lamina obovate or oblong (or in some immature leaves suborbicular), gray- or yellow-green, irregularly lobed, or entire toward the rounded or decurrent base, glabrous except along base of midrib beneath, the tissue firm-membranaceous, somewhat translucent; veins free, pinnately branched from a midrib which is distinct at least in the lower half of the blade, obliquely ascending, once- or twice-forked, their tips connected by a spurious submarginal vein which is continuous around the perimeter of the lamina, spurious veinlets present, parallel to the true veins; sori few to 9, situated near apex of lamina, fully immersed in the tissue; indusium cylindric-turbinate, not bilabiate, the mouth somewhat flaring, not dark-margined; receptacle short- to long-exserted; spores subglobose, coarsely verrucate.

***Trichomanes galeottii* Fourn. Bull. Soc. Bot. France 15: 148. 1868.**

In forests on tree trunks or on wet rocks along streams or waterfalls, sea level to 1,500 m.; Alta Verapaz; Chiquimula; Izabal; Petén. Cuba; Puerto Rico; Mexico (Oaxaca); British Honduras; Honduras; Nicaragua; Costa Rica; Colombia (Chocó).

Plants epiphytic or occasionally saxicolous; rhizome stout, ascending or suberect, provided with dark brown, pluricellular trichomes; leaves monomorphous, caespitose, 5-25 cm. long and 1.5-4 cm. broad; petiole 1.5-8 cm. long, wiry, subterete or flat-

tened, gray- or red-brown, alate halfway or more to the rhizome, abundantly provided with reddish brown, septate trichomes which have the basal cell much shorter and broader than the others; lamina linear, lanceolate or narrow-ovate, dark green or yellow-green, membranaceous, pinnate to pinnatisect, with the basal pair or two of pinnae somewhat reduced, narrowed gradually to a pinnatifid apex, the tissue subopaque; rachis broadly alate, with each wing as wide or much wider than the rachis, trichomes abundant as on the petiole; pinnae 10 to many pairs, oblong, subopposite to alternate, spreading at nearly right angles from the rachis, contiguous to imbricate (rarely subdistant), obtuse at apex, subentire, slightly repand to crisped, with trichomes (like those of the rachis) scattered along costa, veins and margin; veins free, catadromous, 1- to 2-forked, pinnately arranged, spreading obliquely from the costa, lacking spurious veinlets; sori 1 to 4 at the apex of each pinna, fully immersed in the tissue; indusium narrowly cylindric-turbinate to obconic, slightly or not at all bilabiate, the mouth slightly or not at all flaring, not dark-margined; receptacle long exserted; spores subglobose, surface granular to spinulate.

This is very closely related to *Trichomanes crispum*, but tends to be smaller in stature, with fewer sori on each pinna, and with a broad wing well down the petiole. The petiole of *T. crispum* is at most alate just below the base of the lamina; but more typically the petiole and lower rachis are nonalate. A monographic study, comparing both species throughout their entire range, may reveal that *T. galeottii* is only varietally distinct.

Trichomanes godmanii Hook. in Baker, J. Linn. Soc. Bot. 9: 337. 1866. (Type from Guatemala, without location, *Salvin & Godman s.n.* 1862.)

On tree trunks, 50-700 m.; Alta Verapaz; Izabal; Petén. Cuba; Mexico; British Honduras; Honduras; Costa Rica; Panama.

Plants epiphytic; rhizome long-creeping, slender, densely provided with flattened, orange or reddish brown trichomes which extend up the petiole; leaves monomorphic, rather widely spaced, 1 to 2.5 cm. long and nearly as broad; petiole 1-7 mm. long, slender, subterete or flattened; lamina orbicular to suborbicular, gray- or yellow-green, subentire, plane or slightly undulate, truncate or somewhat decurrent at base, glabrous except along base of midrib beneath, the tissue thin and translucent; veins pinnately branched from a midrib which is distinct in the lower half of the blade, subflabellately branched toward the apex, obliquely ascending, once to several times forked, their tips connected by a spurious, submarginal vein which is continuous around the perimeter of the lamina, spurious veinlets present, both parallel and perpendicular to the true veins (thus the venation apparently reticulate); sori few to 9, situated near apex of lamina, fully immersed in the tissue; indusium cylindric-turbinate, not bilabiate, the mouth commonly flaring, not dark-margined; receptacle short- to long-exserted; spores subglobose, coarsely verrucate.

Trichomanes hymenoides Hedw. Fil. Gen. & Spec. t.3. 1799. *Didymoglossum hymenoides* (Hedw.) Desv., Mem. Soc. Linn. Paris 6: 330. 1827.

In forests, on tree trunks, often along rivers or waterfalls, 1,200-1,600 m.; Alta Verapaz; Baja Verapaz; Chiquimula; San Marcos; Sololá. West Indies; Southern Mexico; British Honduras; Costa Rica; Panama; Trinidad; Venezuela and Colombia southward to Uruguay and Argentina.

Plants (in our area) epiphytic; rhizome long-creeping, densely provided with dark brown or blackish, flattened trichomes which extend up the petiole and occasionally onto the base of the rachis; leaves monomorphous, widely spaced, often forming dense mats, (0.5) 1-3.5 cm. long and 0.3-1.5 cm. broad, subsessile to short-petiolate; petiole 0.1-1 cm. long, subterete or flattened, brown; lamina subreniform, broadly elliptic or obovate, shallowly lobed to pinnatifid (very rarely bipinnatifid), with sinuses between pinnae acute to broadly rounded, truncate to cuneate and decurrent at base, margin plane to undulate (rarely crispate), yellowish green, tissue membranaceous, translucent, glabrous except for the blackish, marginal trichomes which are simple or bifid, or sometimes stellate in the sinuses; veins free, catadromous, pinnately branched from a midrib which is distinct at least in lower half of lamina, spurious veinlets few between the true veins, not parallel to the margin; sori solitary to several, near apex of lamina, not or scarcely immersed in the tissue; indusium cylindric turbinate, bilabiate, the lips dark-margined, commonly flaring, most of them broader than long; receptacle short- to long-exserted; spores tetrahedral to subglobose, tuberculate.

Trichomanes hymenoides is easily confused with *T. reptans*, for all of the characters may vary from leaf to leaf, even among those on the same rhizome. Thus, to separate the two it is usually necessary to use the key and other characters in combination. It is conjectural whether the two taxa merit more than subspecific distinction.

Trichomanes hymenophylloides v.d. Bosch, Ned. Kruidk. Arch. 5 (3): 209. 1859. *Vandenboschia hymenophylloides* (v.d. Bosch) Copel. Philipp. J. Sci. 67: 53. 1938.

On trees and moist banks in deep forests, 750-2,300 m.; Alta Verapaz; Huehuetenango; San Marcos. Southern Mexico; Costa Rica; Panama; West Indies; Surinam to Colombia; Ecuador; Brazil.

Plants terrestrial or, more commonly, epiphytic; rhizome thin, long-creeping, delicate, sparsely to abundantly provided with dark brown, flattened trichomes; leaves monomorphous, commonly distant, mature ones 2.5-14 cm. long and 1.5-4 cm. broad, the laminae much longer than their petioles; petiole 0.5-5 cm. long, light or dark brown, flattened, narrow wings present on the upper portion or lacking; lamina ovate or obovate, yellow- or gray-green, membranaceous, translucent, bipinnate-pinnatifid or tripinnate, scarcely reduced at base, narrowed gradually to a pinnatifid apex; rachis glabrous or obscurely dotted with minute trichomes on the abaxial side, narrowly alate throughout (each wing much narrower than the rachis); pinnae 4-10 pairs, alternate, short-stalked, obliquely ascending, lanceolate to ovate, tissue glabrous but axes and veins often with scattered, minute trichomes, costa and costules alate; ultimate segments linear, 0.6-0.9 mm. broad, emarginate, lateral margins

entire, the tissue essentially plane; veins free, anadromous, spurious ones absent; sori 1-3 (4) per pinna, terminating the proximal veinlets, both stalk and tube flanked by a narrow wing of tissue; indusium narrowly funnelform, the tube 2 or more times as long as broad, the mouth flaring but not bilabiate nor dark-margined; receptacle long-exserted, spores tetrahedral, surface baculate to spinulate.

It is questionable whether this fern is distinct from *Trichomanes diaphanum*. Other than the amount of tissue flanking the main axis, the two hardly differ. Perhaps *T. hymenophylloides* more often has merely a single sorus per pinna and is slightly less dissected, but these conditions vary too often to be of real importance. Also, the amount of tissue along the axes, even in leaves on the same rhizome, may be variable. This is particularly true of West Indian plants. Furthermore, the two taxa share approximately the same geographic distribution.

***Trichomanes krausii* Hook. & Grev. Icon. Fil. t.149. 1831. *Didymoglossum krausii* (Hook. & Grev.) Presl, Abh. Böhm. Ges. Wiss. V: 115. 1843. *Hemiphlebium krausii* (Hook. & Grev.) Prantl, Unters. Morph. Gefäss. I: Hymenoph. 46. 1875.**

In dense, wet forests, often along rivers and streams, on tree trunks and (outside of our area) on wet, shaded rocks, sea level to 1,650 m.; Alta Verapaz; Chiquimula; Izabal; Petén; Sololá; Suchitopéquez. Florida; Mexico to Panama; West Indies; Trinidad and the Guianas to Colombia, and southward to Argentina and Paraguay.

Plants (in our area) epiphytic; rhizome long-creeping; densely provided with dark brown to blackish, flattened trichomes which extend onto the petiole and lower rachis; leaves monomorphic, rather widely spaced, often forming dense mats, to 5 cm. long and 3 cm. broad, sessile to short-petiolate; petiole 0.1-0.5 cm. long, subterete or somewhat flattened, brownish; lamina narrow-ovate to elliptic to obovate, deeply pinnatifid or bipinnatifid, with sinuses between pinnae or segments broadly rounded, abruptly narrowed and slightly decurrent at base, margin slightly to strongly undulate, yellowish green, tissue membranaceous, translucent (often scarcely so), glabrous except for the blackish trichomes which are bifid along the margins, but stellate in the sinuses between pinnae or segments; rachis narrow-alate; pinnae narrow, ascending, lobed to pinnatifid; veins free, pinnately branched from the costa at an oblique angle, catadromous, spurious veinlets seldom numerous, parallel to true veins and often parallel to and very near the margin; sori on each pinna solitary or few, terminating the segments, fully immersed except for the lips, at least a narrow wing of tissue flanking each side of the indusium; indusium cylindric-turbinate up to the flaring mouth, bilabiate, lips dark-margined (though sometimes only scarcely so); receptacle short- to long-exserted; spores subglobose, densely tuberculate.

Although reported in Guatemala only as an epiphyte, *Trichomanes krausii* has been found growing on wet rocks, often in streams, from Nicaragua to South America, and in the West Indies.

Trichomanes membranaceum L. Sp. Pl. 1097. 1753. *Lecanium membranaceum* (L.) Presl, Abh. Böhm. Ges. Wiss. V (3): 104. 1843. *Hemiphlebium membranaceum* (L.) Prantl, Unters. Morph. Gefäss. I: Hymenoph. 46. 1875. *Lecanolepis membranacea* (L.) Pic. Ser. Webbia 28: 449. 1973.

On tree trunks, mostly in deep shade in forests, sea level to 160 m.; Izabal. British Honduras; Nicaragua; Costa Rica; Panama; West Indies; the Guianas to Colombia and southward to Bolivia.

Plants epiphytic; rhizome long-creeping, slender, densely provided with flattened, dark brown trichomes; leaves monomorphic, rather widely spaced, in ours 1.5-5 cm. long and nearly as broad, subsessile; lamina suborbicular and entire, or spatulate and shallowly to deeply incised into irregular lobes, grayish green, often drying brown, lacking a distinct midrib, tissue membranaceous, opaque, glabrous, but the margin bearing numerous, distinctive, cordate, suborbicular scales (which are often deciduous on mature leaves); veins free, numerous, flabellate, repeatedly forked, spurious veinlets abundant and parallel with the true veins, but a continuous peripheral one lacking; sori several to many on vein tips toward apex of lamina, partially to fully immersed in the tissue; indusium narrow-cylindrical, scarcely bilabiate, the mouth not flaring nor dark-margined; receptacle short- to long-exserted; spores tetrahedral to subglobose, coarsely granular.

Trichomanes ovale (Fourn.) W. Boer, Acta Bot. Neerl. 11: 296. 1962. *Didymoglossum ovale* Fourn. Bull. Soc. Bot. France 19: 240. 1872.

On tree trunks, sea level to 370 m.; Izabal, Petén; Suchitepéquez. Honduras; Panama; Greater Antilles; Venezuela; Brazil.

Plants epiphytic; rhizome long-creeping, filiform, densely covered with dark brown or blackish, flattened trichomes; leaves monomorphic, approximate to widely spaced, often forming dense mats, to 0.8 cm. long and 0.4 cm. broad, with petiole half the length of the lamina or shorter; lamina suborbicular, ovate or obovate, base rounded to decurrent, margin entire to sinuate or crenate, essentially plane, yellow- to gray-green, with midrib distinct (in fertile leaves) or lacking, tissue membranaceous, translucent, glabrous except for the marginal, stellate trichomes; veins free, flabellate, or pinnately arranged (especially in fertile laminae), once or several times forked, spurious veinlets scattered parallel with the true veins; sorus solitary at lamina apex, partially or fully immersed in the tissue; indusium cylindrical-turbinate, bilabiate, the lips flaring and bicolorous, the edges brownish; receptacle scarcely or not exserted; spores subglobose, coarsely tuberculate.

This is one of the tiniest of all ferns, and is perhaps frequently overlooked by collectors. Thus the apparent disjunct distribution,

reflected by current collections, is probably not indicative of the true range of *Trichomanes ovale*.

Trichomanes petersii A. Gray, Amer. J. Sci. 2 (15): 326. 1853. *T. schaffneri* Schlecht., Linnaea 26: 368. 1853. *Microgonium petersii* (A. Gray) v.d. Bosch, Verh. Kon. Ned. Acad. Wetensch. 9 (6): 7. 1861. *Hemiphlebium petersii* (A. Gray) Prantl, Unters. Morph. Gefäss. I: Hymenoph. 46. 1875. *Didymoglossum petersii* (A. Gray) Copel. Philipp. J. Sci. 67: 78. 1938.

Growing on tree trunks in forests, 150-1,600 m.; Alta Verapaz; Baja Verapaz. Mexico; southeastern United States.

Plants (in our area) epiphytic; rhizome long-creeping, slender, densely provided with flattened, dark brown trichomes; leaves monomorphic, approximate to widely spaced, often forming dense mats, to 1 cm. long and 0.4 cm. broad, with petiole short or nearly as long as the lamina; lamina ovate to elliptic-ovate, apex obtuse, base rounded to cuneate and long-decurrent, margin entire, sinuate or shallowly lobed, weakly undulate, yellow- to gray-green, with a distinct midrib, tissue membranaceous, scarcely translucent, glabrous except for the blackish, forked or stellate trichomes scattered along the margin; veins free, pinnately arranged, obliquely ascending, simple or once-forked, spurious veinlets scattered parallel with the true veins; sorus solitary at lamina apex, fully immersed in the tissue; indusium cylindric-turbinate up to the flaring mouth, not bilabiate nor dark-margined; receptacle scarcely or not exerted; spores subglobose, densely but minutely granular.

Although heretofore reported only as an epiphyte in Mexico and Guatemala, *Trichomanes petersii* occasionally has been found growing on wet rocks in the southeastern United States.

Trichomanes pinnatum Hedw. Fil. Gen. et Sp. t.4. 1799. *T. pennatum* Kaulf. Enum. Fil. 264. 1824. *Neuromanes pinnatum* (Hedw.) Trevis. Herb. Crypt. Trevis. 4. 1851.

In shaded ravines and on ridges and slopes in forests, sea level to 500 m.; Alta Verapaz; Izabal; Petén; Zacapa. West Indies; Trinidad; Mexico to Panama and southward to Brazil and Bolivia.

Plants terrestrial; rhizome short-creeping to ascending, provided with lustrous, dark brown to black, subterete trichomes; leaves essentially monomorphic (although fertile ones are often somewhat larger and with longer petioles), approximate or subcaespitose, to 70 cm. long and 27 cm. broad, lamina as long as, or slightly longer than the petiole; petiole stout or wiry, terete or rounded-trigonal, gray- or red-brown, nonalate (or slightly marginate near base of blade), provided with scattered, filiform, septate trichomes; lamina ovate to subdeltoïd, commonly yellowish green, membranaceous, pinnate, not or scarcely reduced at base, the apex terminating in a conform, elongate pinna, or the rachis often prolonged, flagellate and proliferous at the tip, the tissue translucent, glabrous; rachis nonalate to narrowly alate, with scattered to abundant trichomes; pinnae 4-16 pairs, linear-lanceolate, suboppo-

site to alternate, distant (or contiguous on sterile blades), sessile or subsessile, acute to subacute, truncate at base, or adnate on the proximal side, margin serrate to sub-spinulose, the costae with scattered to abundant, septate trichomes beneath; veins pinnately arranged, approximate, spreading from costa at a wide angle, catadromous, simple or once-forked, joined or nearly joined with numerous, perpendicular, spurious veinlets; sori arranged in a nearly uninterrupted line along each margin, stalked or subsessile on the tips of veins; indusium cylindric-turbinate, not bilabiate, or only scarcely so, the mouth not flaring or only scarcely so; receptacle long-exserted; spores tetrahedral to subglobose, tuberculate.

Trichomanes polypodioides L. Sp. Pl. 1098. 1753. *T. sinuosum* Rich., Willd. Sp. Pl. 5: 502. 1810.

In wet forests, pendent from trunks of trees and tree ferns, 300-1,800 m.; Alta Verapaz; Baja Verapaz; Chiquimula; Huehuetenango; Izabal; San Marcos. Southern Mexico; British Honduras; Honduras; Costa Rica; Panama; West Indies; Trinidad; South America to Paraguay, Brazil and Uruguay.

Plants epiphytic; rhizome long-creeping, slender, provided with scattered brown, flattened trichomes; leaves monomorphic, widely spaced, 4-15 cm. long and 1-3 cm. broad; petiole short, commonly less than 0.5 cm. long, delicate, subterete, greenish or brown; lamina linear-lanceolate, yellowish green, deeply lobed to pinnatifid from apex to the decurrent base, the tissue translucent and glabrous except at the margin, the midrib, veins and margins provided with scattered, brown, stellate trichomes; segments (lobes) 10-25 pairs, oblique, obtuse, often as broad as long, with sinuses acute to rounded, margins subentire, sinuate or broadly crenate; veins free, pinnately branched, rather widespread, spreading from the midrib at an oblique angle, catadromous, spurious veinlets lacking; sori one to a few at segment apex, fully immersed in the tissue at vein tips; indusium salverform, not bilabiate, mouth somewhat flaring, not dark-margined; receptacle long-exserted; spores subglobose, coarsely tuberculate.

Trichomanes punctatum Poiret ssp. **sphenoides** (Kunze) W. Boer, Acta Bot. Neerl. 11: 301. 1962. *T. sphenoides* Kunze, Farnkr. 216. 1840. *Didymoglossum sphenoides* (Kunze) Presl, Abh. Böhm. Ges. Wiss. V: 115. 1943. *Hemiphlebium sphenoides* (Kunze) Prantl, Unters. Morph. Gefäss. I: Hymenoph. 46. 1875.

On tree trunks, in deep shade, 30-150-m.; Alta Verapaz. Greater Antilles; Costa Rica; Panama; Colombia; Venezuela; Peru; Bolivia.

Plants epiphytic; rhizome long-creeping, filiform, sparsely to densely provided with dark brown, flattened, trichomes; leaves monomorphic, approximate or rather widely spaced, to 1.5 cm. long and 1 cm. broad, subsessile or short-petiolate; lamina suborbicular (especially when immature) to obovate or spatulate, base rounded to decurrent, margin essentially plane, entire or irregularly lobed, the lobes often deep and narrow, yellow- to gray-green, a distinct midrib lacking, tissue membranaceous, commonly translucent, glabrous except for the stellate marginal tri-

chomes; veins free, flabellate, repeatedly forked, with spurious veinlets parallel to the true veins; sori several, or often solitary, partially immersed in the tissue, commonly borne between lobes, thus rarely exerted beyond the outline circumscribed by the lobe apices; indusium cylindric-turbinate, bilabiate, the lips mostly wide-flaring, the edges dark-margined; receptacle not or scarcely exerted; spores subglobose, coarsely tuberculate.

Trichomanes pyxidiferum L. Sp. Pl. 2: 1098. 1753. *Vandenboschia pyxidifera* (L.) Copel. Philipp. J. Sci. 67: 53. 1938.

On trees and moist, clay banks, in forests, 900-3,000 m.; Alta Verapaz; Chiquimula; Quezaltenango; Sololá; Suchitepéquez. West Indies; Mexico; Honduras; Nicaragua; Costa Rica; Panama; Colombia to Bolivia and Brazil; Old World.

Plants epiphytic, rarely terrestrial; rhizome slender, long-creeping, rather abundantly provided with blackish, subterete or flattened trichomes which often extend onto the lower portion of the petiole; leaves monomorphous, distant, but sometimes thickly matted, 3-10 cm. long and 1.5-5 cm. broad in maturity, the laminae much longer than their petioles; petiole 1-3 cm. long, subterete or flattened, narrow-alate partially or wholly to base, green (concolorous with the tissue) or brownish; lamina lanceolate to ovate, yellow- or gray-green, membranaceous, translucent or scarcely so, sub-bipinnate to subtripinnate, scarcely or not at all reduced at base, narrowed gradually to a pinnatifid apex; rachis alate, glabrous, or on the abaxial side with scattered, minute trichomes; pinnae 4-10 pairs, alternate, subsessile, anadromous, obliquely ascending, lanceolate to ovate, tissue glabrous, but axes and veins often with scattered, minute, glandular trichomes; ultimate segments linear, obtuse, commonly retuse, margins plane to undulate, tissue (at least in dried specimens) commonly with elongate, narrow folds parallel to the veins; veins free, anadromous, spurious ones absent; sori one to several per pinna, terminating the proximal veins, immersed in the tissue (or at least a narrow wing of tissue along each side of the indusium); indusium broadly turbinate, the tube nearly as broad as long, very shallowly or not at all bilabiate, with mouth scarcely flaring, not dark-margined; receptacle commonly long-exserted; spores tetrahedral to subglobose, sparsely to densely tuberculate.

Trichomanes radicans Sw. J. Bot. (Schrader) 1800 (2): 97. 1801. *T. scandens* Hedw. Fil. Gen. Sp. pl. 6. 1799 (not *T. scandens* L. 1753). *T. kunzeanum* Hook. Sp. Fil. 1: 127, t.39d. 1844. *T. mexicanum* v.d. Bosch, Ned. Kruidk. Arch. 5: 164. 1861. *Vandenboschia radicans* (Sw.) Copel. Philipp. J. Sci. 67: 54. 1938.

In forests and shaded ravines, on tree trunks, wet cliffs and ravine banks, or on mossy rocks, 900-3,300 m.; Alta Verapaz; Baja Verapaz; El Progreso; Guatemala; Huehuetenango; Jalapa; Quezaltenango; Sacatepéquez; San Marcos; Santa Rosa; Sololá; Suchitepéquez; Zacapa. West Indies; Mexico to Panama; Colombia to the Guianas and southward to Brazil and Paraguay; Old World.

Plants terrestrial to epiphytic; rhizome stout, long-creeping, densely provided with dark brown, septate trichomes; leaves monomorphous, distant, 22-50 cm. long, (6) 10-20 cm. broad; petiole (2) 5-12 cm. long, stout, terete at base but becoming flattened or broadly sulcate above on the adaxial side, yellow- to gray-brown, nonalate or with minute wings near the base of the lamina; lamina lanceolate to ovate, dark green or gray-green, often drying blackish, firm-membranaceous, opaque, bipinnate to tripinnate-pinnatifid, scarcely reduced at base, narrowed gradually to an acuminate, pinnatifid apex; rachis essentially glabrous, narrow-alate (or not at all in the lower portion); pinnae 12-18 pairs, commonly 4-10 cm. long, alternate, stalked, ascending (most at a 45-60° angle from the rachis), lanceolate to narrow-ovate, glabrous; ultimate segments linear to narrow-oblong, subacute, obtuse, or retuse to bifid, margins entire, essentially plane; veins free, anadromous, pinnately arranged, strongly ascending, several times forked, spurious ones absent; sori commonly terminating the proximal veinlets of the pinnules, not or scarcely immersed in the tissue; indusium narrow-funnelform or narrow-cylindric, scarcely or shallowly bilabiate, the mouth rarely or never flaring; receptacle usually long-exserted; spores subglobose, surface tuberculate to low-spinulate.

This occasionally has been confused in herbaria, and by some authors, with the West Indian *Trichomanes scandens* L., which it superficially resembles. Hemsley (Biol. Cent. Am. 3: 604. 1885) lists *Bernoulli & Cario 369* from Mazatenango, as *T. scandens*, but I have not seen this, nor have I found other collections of the species from Guatemala.

Trichomanes reptans Sw., Prodr.: 136. 1788. *T. quercifolium* Hook. & Grev., Icon. Fil. t.115. 1829. *T. montanum* Hooker, Icon. Plant. t.187. 1837. *Didymoglossum reptans* (Sw.) Presl, Abh. Böhm. Ges. Wiss. V: 115. 1843. *Hemiphlebium reptans* (Sw.) Prantl, Unters. Gefäss. I: Hymenoph. 46. 1875.

In forests, on tree trunks and branches, or on wet rocks, often along rivers or beneath falls, 800-3,200 m.; Alta Verapaz; Baja Verapaz; El Progreso; El Quiché; Huehuetenango; Jalapa; Quezaltenango; San Marcos; Sololá; Suchitepéquez; Zacapa. Jamaica; Hispaniola; Southern Mexico; Honduras; Nicaragua; Costa Rica; Panama; Colombia and Venezuela southward to Argentina.

Plants saxicolous or epiphytic; rhizome long-creeping; densely provided with dark brown to blackish, flattened trichomes which extend up the petiole and lower rachis; leaves monomorphous, rather widely spaced, often forming dense mats, 2-9 cm. long and 1-4 cm. broad, subsessile to short-petiolate; petiole 0.1-2 cm. long, subterete or somewhat flattened, brownish; lamina lanceolate to ovate or elliptic, pinnatifid to (rarely) bipinnatifid, with sinuses acute to broadly rounded, truncate or cuneate and somewhat decurrent at base, margin plane or slightly undulate, yellowish green, tissue membranaceous, translucent (often scarcely so), glabrous except for the blackish, marginal trichomes which are simple or bifid, or stellate in the sinuses; rachis narrow-alate; pinnae narrow, ascending, sinuate to shallowly lobed;

veins free, pinnately branched in the pinnae, catadromous, spurious veinlets numerous, only (rarely) a few parallel and close to the margin; sori on each pinna solitary or a few, commonly on the distal portion of the lamina, not or scarcely immersed in the tissue; indusium cylindric-turbinate, bilabiate, the lips dark-margined, extended, sometimes flaring, most of them as long as or longer than broad; receptacle short- to long-exserted; spores subglobose, tuberculate.

It is often difficult to distinguish between this and *Trichomanes hymenoides*. Further discussion may be found under the latter species.

Trichomanes rigidum Sw., Prodr. 137. 1788 (not *T. rigidum* Hedw. 1802). *T. mandiocanum* Raddi, Pl. Bras. 1: 64. 1825. *Selendesmium rigidum* (Sw.) Copel. Philipp. J. Sci. 67: 81. 1938.

Damp forests and wooded ravines, 950-1,650 m.; Alta Verapaz; Baja Verapaz; Huehuetenango; Izabal. West Indies; Southern Mexico; Honduras; Nicaragua; Costa Rica; Panama; southward to Brazil and Bolivia; Old World tropics.

Plants commonly terrestrial (rarely low epiphytes); rhizome stout, erect or ascending, or rarely short-creeping, provided with lustrous, dark brown, acicular, septate trichomes which are often densely tufted at rhizome apex; leaves to 35 cm. long, monomorphous, approximate or subcaespitose, with laminae as long as, or slightly longer than, their petioles; petiole stout, terete or slightly flattened, yellow-to gray-brown, nonalate (rarely minutely marginate), with widely scattered trichomes; lamina ovate to subdeltoïd, olive green or dark green, firm membranaceous, subopaque, 3- to 4-pinnate, not or scarcely reduced at the base, narrowed gradually to a pinnatifid apex; rachis glabrous or with scattered septate trichomes, nonalate, or only scarcely so; pinnae 12-20 pairs, alternate, stalked, spreading or (more commonly) ascending, lanceolate or linear-lanceolate, with dark brown glands or glandular trichomes scattered along the abaxial side of the axes; ultimate segments linear, glabrous, often curled on drying, acute or retuse to bifid, margins entire; veins free, pinnately arranged, strongly ascending, anadromous, spurious ones absent; sori short-stalked, commonly terminating the proximal veinlets; indusium narrow-funnelform, slightly marginate on either side, scarcely or shallowly bilabiate, the mouth rarely flaring, subentire or erose; receptacle much exserted; spores subglobose, densely but minutely tuberculate.

Trichomanes tuerckheimii Christ, Hedwigia 44: 361. 1905.

In dense forest, climbing trees, with leaves closely appressed to the trunks, 50-500 m.; Alta Verapaz; Izabal. Southern Mexico; British Honduras; Costa Rica; Panama; Colombia; Venezuela; British Guiana; Surinam; Peru.

Plants epiphytic; rhizome long-creeping, stout and wiry, sparsely to abundantly provided with dark brown, flattened trichomes; leaves monomorphous, widely spaced, to 16 cm. long and 6 cm. broad (rarely to 30 cm. long), subsessile; petiole 1-3 mm. long, terete, greenish, glabrous or with scattered, brownish trichomes, and

with a small, dense tuft of blackish trichomes at the base; lamina broadly oblong, dark green to yellow-green, often drying blackish, pinnatisect, truncate at base, tapering to a gradually pinnatifid apex, the tissue membranaceous and translucent, the rachis, costa, and often the veins and margins rusty tomentose on the abaxial side; pinnae commonly 4-18 pairs, adnate and essentially perpendicular to the rachis, crowded or imbricate, with apices broadly rounded or often retuse, margins plane, entire to crenate; veins pinnate, free, simple, oblique, catadromous, commonly terminating short of the margin, spurious veinlets few, extremely short, parallel to main veins, predominantly situated near the margin; sori few to several, short-stalked, borne on vein tips along the lateral margins of pinnae; indusium narrow-cylindric or narrow-turbinate, not or scarcely bilabiate, mouth not flaring; receptacle commonly long-exserted; spores tetrahedral, coarsely and deeply spinose.

Trichomanes tuerckheimii has perhaps the most peculiar habit of any of the Guatemalan species in the genus. It is found climbing trunks of trees with its leaves tightly appressed to the bark, to which they adhere by means of rust-colored, prehensile trichomes abundant along the abaxial side of veins and midribs and often along the margins.

PLAGIOGYRIACEAE

Plants coarse, terrestrial, glabrous (at least at maturity); rhizome stout, erect, dictyostelic, woody, provided with hard, fibrous roots, old leaf bases crowded and persistent; leaves to 1 m. long, circinate in veneration, dimorphous, fertile ones with longer petioles and narrower, constricted pinnae; petiole subtriangular, sulcate, commonly flattened and slightly expanded at the sheathlike base, not articulate at the caudex, with a double row of pneumatophores at base, which are generally withered or worn away on mature plants; laminae pinnate or pinnatifid, herbaceous to subcoriaceous, lanceolate or narrowly ovate; sterile pinnae entire or (in ours) serrulate to biserrate; veins free, simple or variously forked; fertile pinnae subentire to erose, with margins at first reflexed and partially protecting the developing sporangia, the tissue later spreading, or sometimes so strongly retroflexed that both edges touch on the adaxial side; sporangia exindusiate, covering the abaxial side of fertile pinnae on both sides of the costa, not arranged in definite sori, each long-stalked (4-6 rows of cells), with an oblique annulus uninterrupted by the stalk, dehiscing laterally; spores trilete, smooth to tuberculate, 48 in each sporangium.

The family consists of one genus, with about 30 closely related species which are essentially confined to wet, montane areas, in Asia and tropical America. The dimorphous leaves are borne on erect rhizomes approximately 1.5 cm. in diameter, which often appear 3-4 times as thick due to the crowded, persistent, petiole bases. Thus they sometimes have the aspect of diminutive tree ferns. The sterile leaves arise somewhat obliquely from the rhizome in a circular pattern, from the center of which spring several fertile

leaves. The habit of the plant resembles that of *Osmunda cinnamomea*.

PLAGIOGYRIA (Kunze) Mettenius

References: G. Mettenius, Ueber einige farngattungen, 2: *Plagiogyria*, Abh. Senckenberg. Naturf. Ges., Frankfurt, 1858. E. B. Copeland, The fern genus *Plagiogyria*, Philipp. J. Sci. 38: 377-417. 1929. D. B. Lellinger, The American species of *Plagiogyria* sect. *Carinatae*, Amer. Fern. J. 61: 110-118. 1971.

Characters are those of the family. The following two species occur in Guatemala.

- a. Sterile pinnae 4-6 mm. wide; veins solitary, simple or once forked at or above the base. *P. pectinata*.
- a. Sterile pinnae 8-9 mm. wide; veins (most of them) paired, or forked from the base, with branches again forked above the base (or some veins solitary and once forked) *P. semicordata*.

Plagiogyria pectinata (Liebm.) Lellinger, Amer. Fern J. 61: 115. 1971. *Lomaria pectinata* Liebm. Kongel. Danske Vidensk. Selsk. Skr. V. 1: 233 (seors. 81). 1849. (type from Oaxaca, Mexico, *Liebm.*). *L. arguta* Fée, Mém. Fam. Foug. 8: 70. 1857 (type from Veracruz, Mexico, *Schaffner* 98). *Plagiogyria aequidentata* Fourn. Mex. Pl. 1: 133. 1872 (type from Veracruz, Mexico, *F. Müller* 723). *P. arguta* (Fée) Copel. Philipp. J. Sci. 38: 407. 1929.

In moist, mountain forests, at about 3,100 m.; Huehuetenango, Mexico.

Rachis and petiole stramineous, the latter dark brown at base; sterile leaf to 58 cm. long and 10 cm. broad, with petiole 4-8 cm. long; sterile lamina deeply pinnatisect, lanceolate, tapering to a pinnatifid apex, commonly narrowed at the base (in ours reduced almost to auricles); pinnae of sterile leaf produced at nearly right angles to the rachis, 4-6 mm. wide (in ours), chartaceous to subcoriaceous, linear, often subfalcate, acute, margins subentire to denticulate and slightly revolute, somewhat dilated at base, with sinuses narrowly to broadly rounded; veins solitary, simple or once-forked at or above the base; fertile leaf pinnate, longer and narrower than the sterile leaf, to 75 cm. long and 7 cm. broad, with petiole 12-20 cm. long, the pinnae about 2 mm. broad, distant, spreading or ascending, often gently curved toward lamina apex, scarcely or not dilated at base, margins strongly retroflexed at maturity, often touching each other across the adaxial side; spores essentially smooth-surfaced, but also provided with scattered to abundant, irregularly disposed tubercles.

In Guatemala and southern Mexico, the sterile laminae of this species are gradually but strongly reduced at the base, with the low-



FIG. 14. *Plagiogyria*. a-c, *P. semicordata*: a, habit (with fertile leaf), $\times \frac{1}{2}$; b, sterile leaf, $\times \frac{1}{2}$; c, portion of pinna, $\times 3$; d, *P. pectinata*, portion of pinna, $\times 3$.

ermost pinnae often only 1 cm. long. However, there are plants in Mexico, north of Oaxaca, with the lowermost pinnae reduced only to about half the length of the longest pinnae. The characters of pinna width, margin, and venation, which are used to distinguish this from *P. semicordata*, are also found to be somewhat variable when comparing large numbers of specimens from tropical America. More exhaustive field studies and greater collecting throughout the range may well prove the two to be conspecific.

Plagiogyria semicordata (Presl) Christ, Farnkr. 176. 1897. *Lomariidium semicordatum* Presl, Epim. Bot. 155. 1849. *Plagiogyria biserrata* Mett. Abh. Senckenberg. Naturf. Ges. II. Plag. 1858. *P. obtusa* Copel. Philipp. J. Sci. 38: 413. 1929.

Cool, wet, mountain forests, 2,200-2,800 m.; Huehuetenango; San Marcos. Cuba; Jamaica; Mexico; Costa Rica; Panama; Colombia and Venezuela to Bolivia.

Rachis and petiole stramineous, the latter dark brown at base; sterile leaf to 80 cm. long and 14 cm. broad, with petiole to 10 cm. long; sterile lamina deeply pinnatisect to pinnate, lanceolate, tapering to a pinnatifid apex, commonly reduced gradually but strongly to the base; pinnae of sterile leaf produced at nearly right angles to the rachis, 8-9 mm. wide (in ours), chartaceous to subcoriaceous, linear-lanceolate, straight or somewhat subfalcate, acute, margins mostly biserrate, plane or slightly revolute, often dilated at base on the distal side, with sinuses (on pinnatisect portions) broadly rounded, or pinna bases subdistant, with little or no connecting tissue along the rachis; veins mostly paired, or forked from the base, with branches again forked above the base, or, less frequently, some veins solitary and once-forked; fertile leaf pinnate, longer and narrower than the sterile leaf, to 90 cm. long and 10 cm. broad, with petiole 16-24 cm. long, the pinnae about 2 mm. broad, spreading or slightly ascending and curved, scarcely or not dilated at base, margins strongly retroflexed at maturity, often touching each other across the adaxial side; spores essentially smooth-surfaced, but also provided with scattered to abundant, irregularly disposed tubercles.

DICKSONIACEAE

Large, terrestrial plants with horizontal, ascending, or (most commonly) erect stems, which are often massive and trunklike and sometimes provided with a dense covering of adventitious roots; leaves ample to huge, to several meters long, circinate in vernation, monomorphic, or dimorphic (fertile lamina or parts of the lamina slightly to strongly constricted); petiole stout, glabrescent to variously pubescent, at the base often densely lanate, not articulate at the stem; lamina 2- to 4-pinnate, chartaceous to subcoriaceous; indument consisting of unbranched trichomes, scales lacking; veins free, simple to several times forked; sori terminal on the veins, marginal, cup-shaped or (in ours) bivalvate, the outer valve of the indusium often a scarcely modified portion of the segment margin; sporangia short- to (in ours) long-

stalked, the annulus oblique, essentially complete, slightly or not at all interrupted by the stalk, dehiscing horizontally; spores 48-64 in each sporangium, trilete, tetrahedral, the exine smooth to granulate or verrucate.

The five genera of the Dicksoniaceae have been considered by some authors to be part of the Cyatheaceae. Others have grouped them with a larger number of genera in the Pteridaceae, a somewhat conglomerate family. Whichever concept one prefers, the more restrictive family circumscribed here certainly proves to be a quite natural one, easily defined and recognized.

There are about 35 species in the family, including the monotypic genera, *Thyrsopteris* (Juan Fernandez) and *Cystodium* (Borneo and the Philippines). The other three genera are represented in Guatemala.

- a. Lamina 4-pinnate or more (in ours); costa and costules deeply sulcate on the adaxial side, the furrow flanked by prominent ribs, which are decurrent onto the axis of the next order *Culcita*.
- a. Lamina tripinnate or subtripinnate; costa and costule raised or only slightly furrowed, the ribs (if any) not decurrent onto the axis of the next order.
 - b. Outer valve of the indusium similar to the inner, both cartilaginous; trichomes on costae and costules (in ours) lax and filiform, whitish to stramineous; paraphyses sparse, minute, concealed by the sporangia. *Cibotium*.
 - b. Outer valve of the indusium consisting of a scarcely altered, revolute crenation of the segment; trichomes on adaxial side of costae and costules rigid and stout, dark brown (in ours); paraphyses abundant, as long or longer than the sporangia *Dicksonia*.

CIBOTIUM Kaulfuss

Reference: W. R. Maxon, The American species of *Cibotium*, Contr. U.S. Natl. Herb. 16: 54-58. 1912.

Stem stout, prostrate to ascending (in ours) or erect and massive; leaves huge, to several meters long, decompound; petiole smooth, essentially glabrous except for a dense matting of reddish trichomes at base; lamina commonly tripinnate, essentially monomorphic, often glaucous abaxially, pinnae stalked, broadly lanceolate; costae and costules raised or, rarely, shallow-furrowed, the raised ribs (if any) not decurrent onto the axis of the next order, variously pubescent, but in ours the trichomes delicate, filiform, lax, spreading or somewhat appressed; ultimate segments more or less symmetric, straight or subfalcate, spreading at broad, nearly right, angles from the costule; veins free, simple or once or several times forked; sori at the ends of veins, attached at the margin of the segment; indusium bivalvate, both valves similar in color and texture, spreading widely apart at maturity; sporangia long-stalked, the annulus oblique, not interrupted by the stalk; paraphyses various, but in ours minute and concealed by the sporangia; spores tetrahedral, trilete.

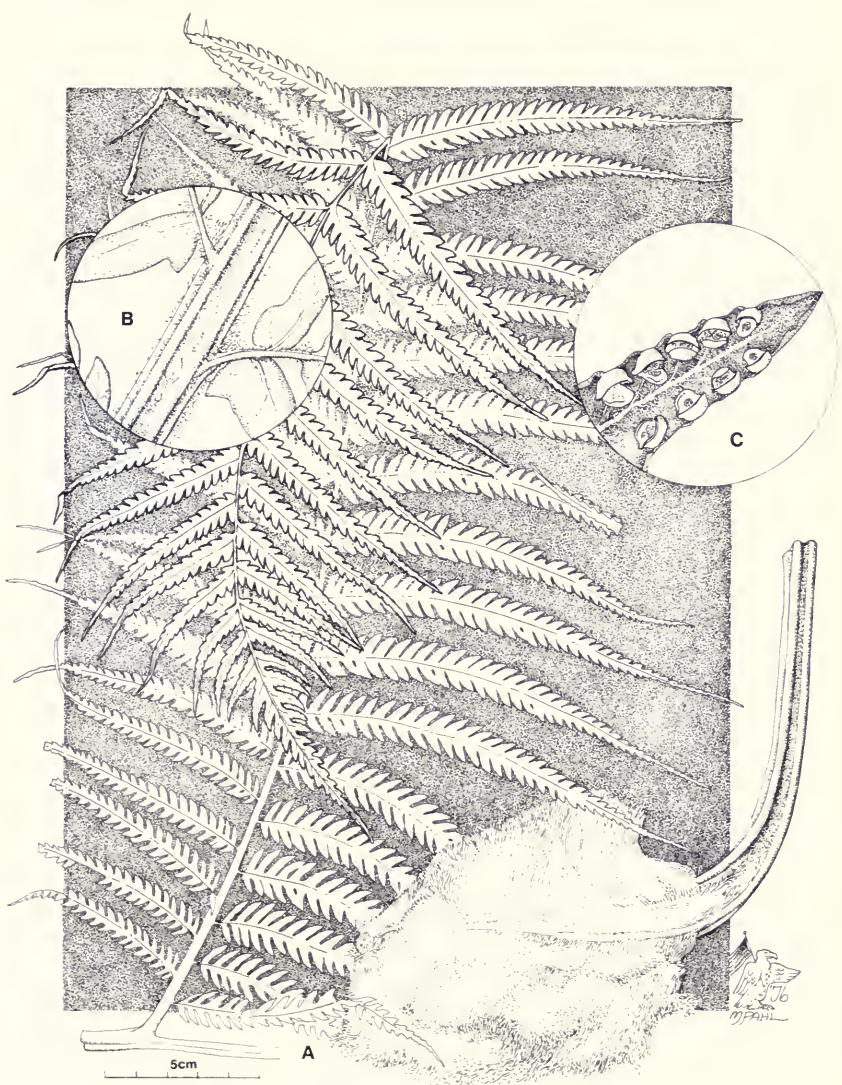


FIG. 15. *Cibotium regale*. a, habit, showing part of lamina and petiole base, $\times \frac{1}{2}$; b, secondary and tertiary axes, adaxial side, $\times 4$; c, ultimate segment, showing position of sori, $\times 5$.

The genus contains eight or ten species, all but two in the Old World, a few with arborescent habit. A single species is recognized in Guatemala.

Cibotium regale Versch. & Lem. Ill. Hort. 15: t. 548. 1868. *C. wendlandii* Kuhn, Linnaea 36: 151. 1869 (type from Guatemala, location unknown, *Wendland s.n.*). *C. guatemalense* Kuhn, *tom. cit.* 152 (type from Guatemala, location unknown, *Wendland s.n.*). *Dicksonia wendlandii* (Kuhn) Bak., in Hook. & Bak. Syn. Fil. ed. 2: 460. 1874. *D. guatemalense* (Kuhn) Bak., *tom. cit.* 461. *D. regalis* (Versch. & Lem.) Bak. *loc. cit.*

Forested slopes or ravines, 750-2,850 m.; Alta Verapaz; Chimaltenango; Chiquimula; Guatemala; Quezaltenango; San Marcos; Sololá; Zacapa. Chiapas (original description based on cultivated specimens collected in Mexico by Ghiesbreght; type probably *Ghiesbreght 351*); Honduras.

Plants acaulescent or with stems erect, stout, to 1 m. tall; leaves to 3 m. long, subcoriaceous; petiole smooth, drying stramineous to light brown (sometimes darker at base), essentially glabrous throughout, but with a dense matting of golden brown trichomes at base; lamina broadly ovate, tripinnate or subtripinnate; rachis smooth, commonly drying stramineous, essentially glabrous; pinnae stalked (1-6 cm.), lanceolate, acute to long-acuminate; costae and costules sparsely to abundantly villous, or glabrescent, the trichomes simple, delicate, appressed to laxly spreading, whitish to stramineous, readily deciduous; pinnules sessile or short-stalked, linear-lanceolate, attenuate to subcaudate, cut nearly to the costule throughout, or fully so near the base; ultimate segments dark green adaxially (drying brownish); lighter abaxially and often glaucous, crenate-serrate, the margins revolute, apex acute (or appearing acuminate or cuspidate due to the inrolled margins), the midrib and veins sparsely to densely villous abaxially, commonly glabrous adaxially; veins simple or once- or twice-forked, 6-11 (15) pairs per segment; sori crowded along the margins, parallel to the midrib or often turned obliquely; paraphyses sparse, minute, concealed by the sporangia.

Three species of *Cibotium* which traditionally have been recognized in Central America are *C. guatemalense*, *C. regale*, and *C. wendlandii*. Maxon and earlier authors based their segregation on various combinations of characters: segments aristate *vs.* acuminate, sori parallel *vs.* oblique to the midrib, lamina glabrous and glaucous *vs.* densely villous and *not* glaucous. These features, if consistent, might constitute a valid basis for segregation, but examination of a large number of specimens from Mexico, Guatemala, and Honduras reveals such characters to be highly variable. Even in individual specimens, the traditional distinctions do not hold up well. Both the type collection of *C. regale* and a specimen (*J. D. Smith 2423*) which Maxon cited as *C. wendlandii* are obvious-

ly villous, yet they are also glaucous. In both, the sori are mostly parallel to the midrib, yet often they are arranged in a somewhat oblique pattern. Finally, both specimens show some variation in the shape of the apices of ultimate segments: on parts of the leaf the segments may be merely acute, yet on other parts the segments are quite acuminate (though *never* truly aristate, as Maxon maintained).

Some of the variability of the above characters may be attributed to the maturation of the leaf, or perhaps to the amount of moisture available. For example, it appears that both the trichomes and "bloom" on the abaxial surface often tend to disappear as the plant ages; and perhaps in age (or desiccation) the segment margins become revolute. The sharp inrolling of the segment margin may turn the sori obliquely and, near the apex, may often cause an acute segment to appear acuminate.

Called "lanilla" in Honduras, this fern is sometimes used for stuffing pillows (fide Standley).

CULCITA Presl

Reference: W. R. Maxon, The genus *Culcita*, J. Wash. Acad. Sci. 12: 454-460. 1922.

Stem stout, prostrate to ascending, plants not or scarcely arborescent; leaves broad, commonly 1 m. long, decompose; petiole smooth, sparsely villous above, to very densely lanate at base; lamina 3- to (in ours) nearly 5-pinnate, essentially monomorphic, glabrous except for the axes and veins; pinnae broadly ovate to subtriangular; costae and costules deeply sulcate on the adaxial side, the furrow flanked by prominent ribs which are decurrent onto the axis of the next order, glabrescent or sparsely provided with lax, mostly spreading trichomes; ultimate segments somewhat oblique, asymmetrical, and inequilateral at base, shallowly lobed to deeply dissected; veins free, simple or forked; sori terminating the veins; indusium subglobose, bivalvate, the outer valve consisting of a scarcely altered, revolute portion of the segment margin, the inner one differing slightly in texture; sporangia long-stalked, the annulus somewhat oblique and slightly interrupted by the stalk; paraphyses filamentous, numerous, as long or longer than the sporangia; spores tetrahedral, trilete.

Culcita may be readily distinguished from the other two genera in Guatemala, as indicated in the key. However, it is apparently more closely allied with *Dicksonia*, with which it shares a number of similar, significant characters, notably the paraphyses, and the outer valve of the indusium.

There are eight species in the genus, several occurring on Pacific Islands, from Samoa to Australia and north to Taiwan. *C. macro-*



FIG. 16. *Culcita coniifolia*. a, habit, showing portion of lamina and petiole base, $\times \frac{1}{2}$; b, portion of lamina, adaxial side, showing ribs continuous along axes, $\times 3\frac{1}{2}$; c, penultimate segment, showing position of sori, $\times 3$.

carpa is found in the Madeira Islands and the Azores. *C. coniifolia* is the only species in the neotropics.

***Culcita coniifolia* (Hook.) Maxon**, Annual Rep. Board Regents Smithson. Inst. 1911: 488, *t. 13c*. 1912. *Dicksonia coniifolia* Hook. Sp. Fil. 1: 70, *t. 24A*. 1844. *D. martiana* Kl. in Hook. Sp. Fil. 1: 70, *t. 24B*. 1844. *Culcita schlimensis* Fée, Mem. Fam. Foug. 10: 47. 1865. *Balantium martianum* (Kl.) Fée, Vasc. Crypt. Bres. 1: 155. 1869. *B. coniifolium* (Hook.) J. Sm. Hist. Fil. 258. 1875.

In dense to open forest, or in bamboo or shrub thickets, 2,000-3,000 m.; Huehuetenango; Jalapa; El Progreso. Greater Antilles; southern Mexico; Honduras; El Salvador; Costa Rica; Panama; Colombia to Surinam, southward to Brazil and Argentina.

Rhizome stout, prostrate or ascending; leaves erect, to 3 m. long; petiole drying light brown, dark brown (or atropurpureus at base), unarmed, provided with filiform, orange or light brown trichomes, these scattered distally, but densely matted at base; lamina broadly triangular, subcoriaceous, to 4- (to nearly 5-) pinnate, monomorphic, or fertile segments slightly constricted; rachis smooth, light or dark brown, sparsely provided with light brown or nearly colorless trichomes, these mostly lax and twisted; pinnae stalked (to 6 cm.) broadly subtriangular, glabrous except for a few lax trichomes along the costae and costules, the latter adaxially sulcate (as the rachis); quaternary segments oblique, somewhat asymmetric, shallowly to deeply lobed or cut almost entirely to the base, the ultimate segments simple and acute, or bifid; sori terminating the veins, at the tip of a simple segment or on the acroscopic lobe of a bifid segment.

DICKSONIA L'Heritier

Reference: W. R. Maxon, The North American tree ferns of the genus *Dicksonia*, Contr. U.S. Natl. Herb. 17: 153-156. 1913.

Stem erect, commonly massive and trunklike, rarely prostrate to ascending, to 6 m. tall and 40 cm. in diameter (including the dense covering of adventitious roots); leaves huge, to several meters long, decompound; petiole smooth, or slightly muricate with the persistent bases of trichomes, glabrous, or sparsely villous, but at base provided with a dense matting of long, golden brown or red-brown trichomes; lamina bipinnate or (as in ours) tripinnate, often glaucous abaxially, slightly to strongly dimorphous, the fertile segments somewhat constricted; pinnae commonly lanceolate, sessile or stalked; costae and costules raised or, rarely, shallow-channeled, the ribs (if any) not decurrent onto the axis of the next order, variously pubescent abaxially, but provided adaxially with a dense covering of stout, light or (in ours) dark brown, antrorse trichomes; ultimate segments more or less symmetric, straight or subfalcate, spreading at a broad angle from the costule; veins free, simple to several times forked; sori terminating the veins; indusium bivalvate, the outer valve consisting of a scarcely altered, revolute portion of the segment margin; the inner one differing somewhat in texture and color; sporangia long-stalked, the

annulus oblique, not interrupted by the stalk; paraphyses (at least in ours) filamentous, numerous, as long or longer than the sporangia; spores tetrahedral, trilete.

Most species of *Dicksonia* are true tree ferns, i.e., the stems are massive, often lofty trunks, and the leaves are huge and spreading and commonly highly dissected. The habit is shared with a number of genera in the Cyatheaceae, notably *Alsophila*, *Cyathea*, *Nephrolepis*, *Sphaeropteris*, and *Trichipteris*. Perhaps coincidentally, perhaps significantly, *Dicksonia* shares another important character with these genera: the adaxial side of costae and costules is abundantly to densely covered with stout, antrorse, pluricellular trichomes.

There are 18-20 species in the genus, about a third occurring in Central and South America. *D. arborescens* L'Herit. is found on St. Helena, and the rest are distributed from Australia and New Zealand to the Philippines. One species is recognized in Guatemala.

Dicksonia gigantea Karst. Fl. Columb. 2: 177. 1869. *D. ghiesbreghtii* Maxon, Contr. U.S. Natl. Herb. 17: 155. 1913 (type from Chiapas, Mexico, *Ghiesbreght 353*).

Arborescent ferns occurring in deep, wet forests, on slopes or in ravines, 1,750-3,200 m.; Baja Verapaz; Quezaltenango; San Marcos; Zacapa. Southern Mexico; Honduras and El Salvador to Colombia.

Stem to 6 m. tall and 20 cm. thick (including a dense covering of adventitious roots); leaves to 3 m. long, spreading to ascending; petiole commonly 15-30 cm. long, drying dark brown or stramineous, smooth, or the proximal portion slightly muricate with the subsistent bases of trichomes, lightly pubescent, or at base provided with a thick matting of golden brown trichomes; lamina tripinnate or subtripinnate, broadly lanceolate, reduced at apex and base, subcoriaceous, fertile ones often somewhat constricted; rachis smooth or slightly muricate, commonly drying stramineous, lightly pubescent as on the petiole; pinnae sessile or short-stalked, acute to acuminate; costae and costules on abaxial side sparsely to abundantly provided with yellow to brownish trichomes, these mostly rigid, antrorse or spreading, on the adaxial side densely covered with mostly dark brown trichomes, these antrorse and rigid; ultimate segments crenate-serrate or deeply lobed, glabrous except for the axes, not or slightly glaucous, slightly to strongly revolute, with apices acute to nearly cuspidate; veins 5-7 (8) pairs per segment, simple to once-forked, or in the deeply lobed segments 2- to 3-forked; sori subdistant along the margins, sometimes crowded, but rarely touching; paraphyses abundant, lax, spreading, as long or longer than the sporangia.

There seems no reason to maintain this and *D. ghiesbreghtii* as separate species. Maxon distinguished the two on rather tenuous grounds: that the latter had one or two more veins per segment, and an extra fork in the veins. With *D. gigantea* perhaps may also be

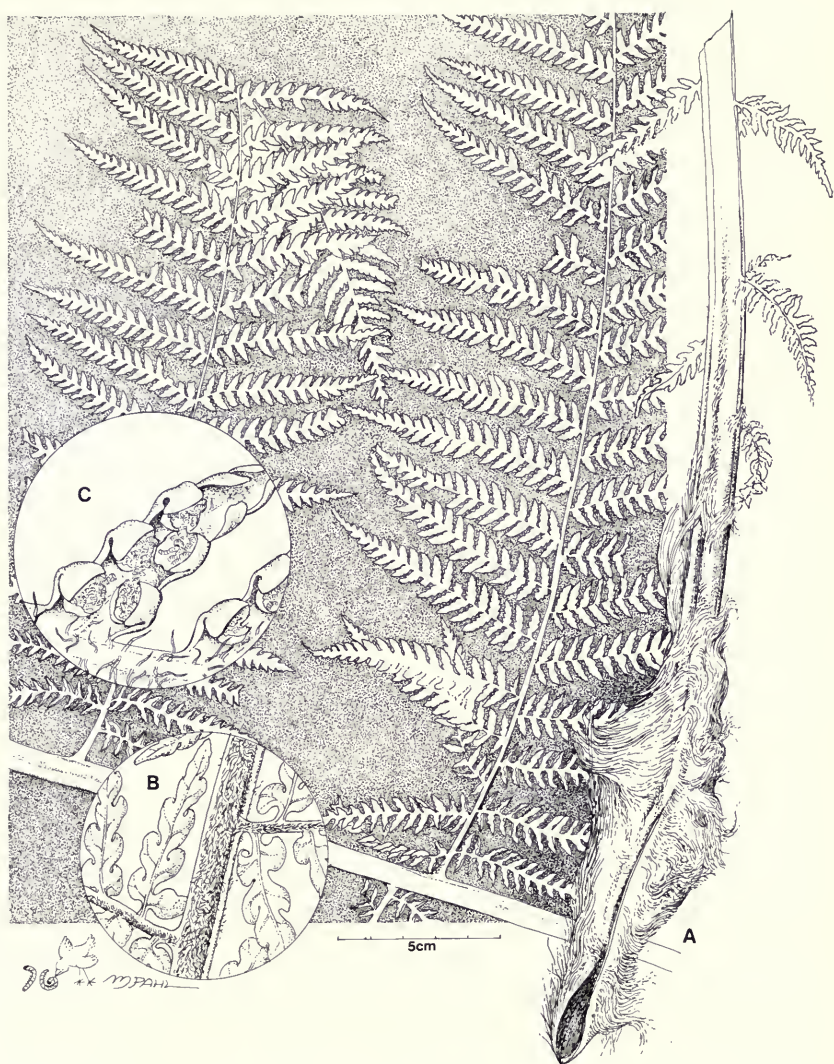


FIG. 17. *Dicksonia gigantea*. a, habit, showing portion of lamina and petiole base, $\times \frac{1}{2}$; b, portion of lamina, adaxial side, $\times 2\frac{1}{2}$; c, ultimate segment, showing position of sori, $\times 6$.

included *D. karsteniana* of Costa Rica and Colombia, which is said to differ by similar characters.

CYATHEACEAE

Reference: R. M. Tryon, The classification of the Cyatheaceae, Contr. Gray Herb. 200: 1-53. 1970.

Large, terrestrial plants with horizontal or (most commonly) erect stems which are typically massive and trunklike and sometimes provided with a dense covering of adventitious roots; leaves small to usually huge, to several meters long, circinate in veneration, essentially monomorphous, borne in a crown at stem apex (or spaced along a creeping rhizome in *Metaxya*), petioles imperfectly deciduous and breaking away irregularly (although in some species the older petiole bases eventually falling away to reveal distinct, regularly spaced scars); lamina 1-pinnate to decompose (simple in one species of Ceylon); indument consisting of scales or trichomes, or both; veins free or, less commonly, the basal ones merging to form costal areoles; sori abaxial on the veins, round, the indusia sphaeropteroid to hemitelioid or lacking; sporangia numerous, ovoid to pyriform, each with an essentially complete, oblique annulus which is uninterrupted by the stalk, dehiscing horizontally; spores 16 to 64 in each sporangium, trilete, tetrahedral to subglobose, smooth or variously sculptured, with or without perine.

Authors have disagreed on the limits of the family. There is strong evidence that *Lophosoria* and *Metaxya* are more closely allied to the non-squamate Dicksoniaceae, or might even be more suitably placed in a separate family, Protocyatheaceae. Still others include in the Cyatheaceae not only *Lophosoria*, *Metaxya*, and the Dicksoniaceae, but *Dennstaedtia*, *Hypolepis*, and other genera. Our treatment follows Tryon's recent classification, which includes *Lophosoria* and *Metaxya* with the six squamate genera. Thus delimited, there are approximately 440 species in the family, occurring in both the neotropics and paleotropics.

Terminology of indusial characteristics is covered in detail in the discussion of *Cyathea*.

- a. Stem and petioles provided with trichomes, scales absent.
 - b. Lamina decompose; segment margins scarcely modified. *Lophosoria*.
 - b. Lamina simply pinnate; segment margins cartilaginous *Metaxya*.
- a. Stem and petioles provided with scales, trichomes may also be present.
 - c. Pinnae entire to shallowly lobed; veins forming costal areoles. . . *Cnemidaria*.
 - c. Pinnae deeply incised or decompose; veins free.
 - d. Some, usually many, scales of the petiole and other axes bearing dark-colored apical (and often marginal) setae.
 - e. Petiole, rachis, and usually the costa blackish *Alsophila*.
 - e. Petiole, rachis, and costa brown to stramineous.

- f. Petiole with stout, sharp, squaminate, blackish spines; petiole scales structurally marginate (marginal cells differentiated from central ones in shape, size and orientation) *Nephelea*.
- f. Petiole lacking stout, squaminate spines (though sometimes muricate with the persistent bases of scales); petiole scales structurally conform (marginal and central cells similar in size, shape and orientation) *Sphaeropteris*.
- d. Scales of the petiole and other axes lacking dark-colored setae (though often with apices filiform and margins erose to fimbriate).
- g. Indusium present, hemitelioid, cyathiform or globose (sides often lacerate and fugacious at maturity) *Cyathea*.
- g. Indusium absent *Trichipteris*.

ALSOPHILA R. Brown

Stem erect, commonly massive and trunklike (in ours to 3 m. tall); leaves to several meters long; petiole variously colored but commonly (as in ours) atropurpureus to blackish, smooth, or slightly muricate with the persistent bases of scales, or rarely with stout, nonsquaminate, conical spines at base (the spines not bearing scalelike remnants at their margins or bases); petiole scales mostly appressed, deep amber to dark brown, often with paler margins, the marginal cells differentiated from those of the central portion in shape, size and orientation, some or all scales bearing dark-colored, apical and (rarely) marginal setae; several pairs of aplebiae occurring near the petiole base, these (at least in ours) highly dissected, 3-18 cm. long, the segments often ephemeral, on dried specimens sometimes completely deciduous from the axes, thus the latter appearing skeletal; lamina bipinnate to tripinnate-pinnatifid; rachis colored as the petiole, glabrous abaxially or with a few scattered, brown scales, appressed-hairy adaxially; pinnae short- to long-stalked, the costae and costules bearing abundant, appressed, minute, pluricellular trichomes on the adaxial side, the costae with scattered to abundant scales on the abaxial side, those of costules and midribs often dark-setose and bullate; veins free, simple or once-forked, on lobed segments the basal veins reaching the margin at a point above the base of the sinus; sori disposed on the veins close to the midribs; indusia scalelike or sphaeropteroid or, more commonly (as in ours), lacking; receptacle commonly elevated and subglobose, and with paraphyses shorter than the sporangia; spores 16 per sporangium (except 64 in *A. salvinii*), exine with or without apertures of various sizes, but commonly lacking a single large, equatorial pore near the center of each face, perine provided with long, irregular ridges.

In *Alsophila*, the dark setae of petiole scales may be often lacking on herbarium specimens, due to the breaking away of scale tips. Setae are more easily observed on costules and midribs on the abaxial side of pinnules, which are better protected.

Gerald Gastony has recently studied the spores of several genera of the Cyatheaceae and reports (in litt.) that one paleotropical species of *Alsophila* has porate exine indistinguishable from that in *Cnemidaria*, i.e., with a single large equatorial pore near the center of each face. He also states that *A. salvinii*, with 64 spores per spor-



FIG. 18. *Alsophila salvinii*. a, habit, pinna, and petiole base, $\times \frac{1}{2}$; b, ultimate segments, $\times 2\frac{1}{2}$; c, portion of segment, with bullate scales, $\times 5$; d, petiole scale, $\times 8$.

angium, is atypical in a genus which commonly has 16-spored sporangia.

Alsophila may be further distinguished from other genera by the presence of aphlebiae (often greatly dissected) at the very base of the petiole. These are pinna-like but quite distant from the lowermost pinnae, and often very different in character. A few species of *Nephelea* have subaphlebioid basal pinnae, but these do not occur at the base of the petiole.

Affinities of the genus are with *Nephelea*, under which see further discussion. *Alsophila* contains over 200 species, most of which occur in the paleotropics. Approximately 12 species are found in the neotropics, but only one in Central America.

***Alsophila salvinii* Hook. in Hook. & Bak. Syn. Fil. 36. 1866.**

Ravines and slopes of cloud forests, 1,300-2,600 m.; Alta Verapaz; Baja Verapaz (type from Chilasco, *Salvin & Godman s.n.*); Chiquimula; Huehuetenango; Jalapa; El Quiché; Zacapa. Mexico (Chiapas); Honduras; El Salvador. *Chispón* (Zacapa, fide Steyermark).

Stem to 3 m. tall; leaves to 2 m. long; petiole to 1 m. long, atropurpureus or black, smooth, slightly muricate due to persistent bases of scales, rarely with a few spines near the base; lamina tripinnate or tripinnate-pinnatifid, dark green above and lighter (often appearing silvery on live plants) beneath; rachis atropurpureus to blackish, essentially smooth, nonalate; pinnae broadly lanceolate, costae dark brown to blackish, abundantly provided with minute, dark brown, appressed, pluricellular trichomes on the adaxial side of costae and costules, and with dark brown, appressed, often setose scales scattered on costae abaxially, abundant and bullate or sub-bullate on costules and midribs; ultimate segments crenate, or lobed halfway to the midrib; veins simple to once-forked; sori inframedial between midrib and margin; indusium lacking; spores 64 per sporangium, tetrahedral, without apertures, surface essentially smooth.

Alsophila salvinii may be readily distinguished from all other species of the family in Guatemala by the uniformly blackish petiole, rachis, and (usually) costae. Other species may be deep brown to blackish (if at all) only toward the base of the petiole.

CNEMIDARIA Presl

References: W. R. Maxon, The North American species of *Hemitelia*, subgenus *Cnemidaria*, Contr. U.S. Natl. Herb. 16: 25-49. 1912. R. G. Stolze, A taxonomic revision of the genus *Cnemidaria* (Cyatheaceae), Fieldiana Bot. 37: 1-98. 1974.

Stem ascending to erect, rudimentary to 1.5 m. long (or, in some species, rarely to 3.5 m. long); leaves to 3.5 m. long and 1.5 m. broad, lanceolate to ovate-oblong; petiole smooth to muricate, or provided with stout, conical spines up to 7 mm. long, and with scales appressed, whitish or bicolorous (dark brown with whitish margins), their marginal cells differentiated from those of the central portion in size, shape and orientation; lamina pinnate to pinnate-pinnatisect, never fully bipinnate, tissue glabrous, scales of the rachis and minor axes lacking or scattered on the abaxial side, whitish to bicolorous or brown, flat (as in ours) or a few species with bullate costal scales, trichomes of rachis and costa stiff, terete, recurved, pluricellular, copious to scattered, or lacking, but always lacking adaxially on costa and costules; pinnae sessile to short-stalked, margins entire to deeply cleft (in ours merely lobed); veins free and connivent to the sinus or more typically (as in ours) the basal ones merging to form costal areoles; sori disposed on the veins in a single line (rarely several lines) between costule and segment margin; indusium commonly hemitelioid, semicircular (rarely fully circular, or reduced to one narrow lobe); receptacle elevated, subglobose, with paraphyses rudimentary or lacking; spores 64 per sporangium, provided with one large pore near the center of each face on or near the equator, and with numerous smaller apertures scattered over the surface, perine lacking.

Cnemidaria is the most distinctive of all the squamate genera of Cyatheaceae. Its species are characterized by the generally acaulescent habit, the comparatively simple leaf architecture, and the basal veins of segments conniving at the sinus or, more commonly, merging to form costal areoles. Moreover, the three large, regularly spaced pores of the spores are practically unique in the family. Typical of the other squamate genera of Cyatheaceae are the arborescent habit, the highly dissected leaves, and the free and nonconnivent veins. *Cnemidaria* is a tropical American genus with 23 species, one of which occurs in Guatemala.

Cnemidaria decurrens (Liebm.) Tryon, Contr. Gray Herb. 200: 52. 1970. *Hemitelia decurrens* Liebm. Kongel. Danske Vidensk. Selsk. Skr. V. 1: 286 (seors. 134). 1849 (type from Lobani, Chinantla, Oaxaca, Mexico, *Liebmann Pl. Mex.* 2089 (no. 912)). *H. mexicana* Liebm. *tom. cit.* 287 (seors. 135) (type from Lacoba, Chinantla, Oaxaca, Mexico, *Liebmann Pl. Mex.* 2105 (3 sheets: nos. 909, 910, 911)). *H. guatemalensis* Maxon, Contr. U.S. Natl. Herb. 16: 40. 1912 (type from Alta Verapaz, *Salvin s.n.*). *H. lucida* (Fée) Maxon, *tom. cit.* 39. *Cyathea guatemalensis* (Maxon) Domin, Pteridophyta 264. 1929. *C. lucida* (Fée) Domin, *loc. cit.*

On slopes, in forests, 200-1,000 m.; Alta Verapaz. Mexico (Chiapas and Oaxaca); Honduras.

Stem rudimentary to 0.3 m. long; leaves pinnate to pinnate-pinnatifid, to 2.5 m. long and 0.8 m. broad; petiole to 0.5 m. long, with spines to 2 mm. long, the scales scattered to abundant, whitish or bicolorous (brown-centered, with whitish mar-

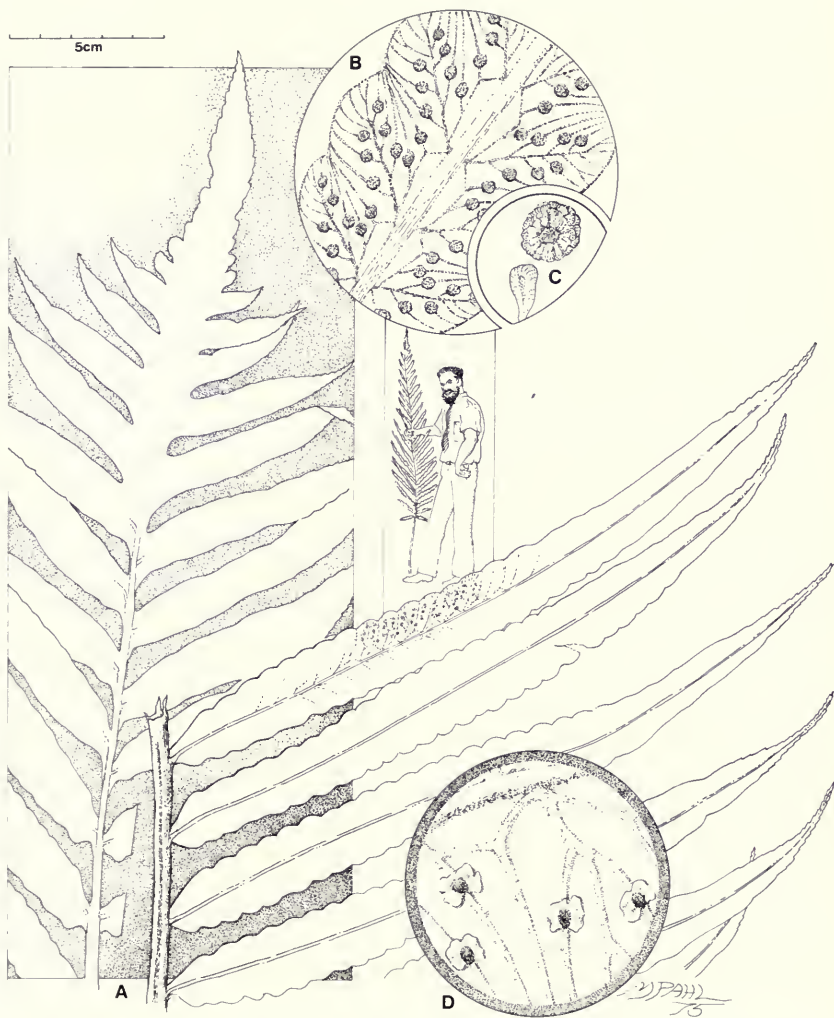


FIG. 19. *Cnemidaria decurrens*. a, habit, $\times \frac{1}{2}$; b, portion of pinna, showing venation, $\times 2$; c, sorus and sporangium, greatly enlarged; d, sori, with sporangia removed to show indusium, $\times 6$.

gins); rachis with membranous wing to 2 mm. wide running partially to fully down each side or (rarely) lacking, provided on the abaxial side with sparse to abundant whitish or bicolorous scales and minute, terete, recurved trichomes; pinnae subsessile, subentire or crenate, or cut one-third to the costa; costae on abaxial side with scattered, broad, amorphous, whitish or bicolorous scales, trichomes lacking; costules with scales and trichomes lacking; secondary segments or lobes (when present) obtuse to rarely subapiculate; veins from the midribs simple, basal ones commonly merging to form costal areoles; indusium semicircular to (rarely) almost fully circular, subentire to several-lobed.

CYATHEA J. E. Smith

References: W. R. Maxon, Cyatheaceae (*Cyathea*, in part) in North Amer. Fl. 16: 65-88. 1909. W. R. Maxon, The North American species of *Hemitelia*, section *Euhemitelia* (in part), Contr. U.S. Natl. Herb. 17: 414-420. 1914. R. M. Tryon, A revision of the genus *Cyathea*, Contr. Gray Herb. 206: 19-101. 1976.

Stem erect, commonly massive and trunklike; leaves to several meters long; petiole smooth to muricate, or provided with nonsquaminate spines (the spines not bearing scalelike remnants along their margins or at their bases), scales commonly appressed, brownish, often with paler or whitish margins, the marginal cells differentiated from those of the central portion in shape, size and orientation, lacking marginal setae; lamina bipinnate or more highly dissected (in ours bipinnate-pinnatisect), the axes variously provided with scales and trichomes abaxially, and (especially on costae and costules) with minute, recurved trichomes on the adaxial side; veins free, simple or branched, in lobed segments the basal veins reaching the margin at a point above the base of the sinus; indusium hemitelioid to globose (sphaeropteroid); spores commonly 64 per sporangium, exine with or without apertures of various size, but lacking a single large equatorial pore near the center of each face.

Cyathea is very closely related to *Trichipteris*. Sterile specimens of some species are difficult to place in either genus, for the chief character by which the two may be distinguished is presence or absence of an indusium.

The indusium in *Cyathea* may be globose (sphaeropteroid) or cup-shaped (cyathiform), thus subtending and completely encircling the sorus, or it may be hemitelioid, i.e., borne proximally on the vein and subtending but only partially encircling the sorus. The hemitelioid indusium is attached by a broad base beneath the receptacle. It may spread up and somewhat over the sorus on the proximal side, or it may be low and saucer-shaped, and sometimes fugacious, thus appearing flattened and scalelike on mature specimens.

A few species of *Trichipteris* may appear indusiate, due to the presence of conspicuous scales around the sori. But close examina-

tion will reveal that these soral scales are attached by very narrow bases, around the receptacle, and not necessarily on the proximal side. Even the smallest of the hemitelioid indusia in *Cyathea* are very broadly attached, describing an arc of 75-180° around the receptacle.

Cyathea is a neotropical genus consisting of about 40 species, three of which are known in Guatemala.

- a. Sori medial to supramedial between midrib and segment margin; indusium hemitelioid, partially encircling the sorus on the proximal side; most ultimate segments 1.5 (2) times as long as broad, beyond the sinus *C. multiflora*.
- a. Sori inframedial between midrib and segment margin; indusium at first globose, later opening and becoming cup-shaped, completely encircling the sorus; most ultimate segments 2-3 times as long as broad, beyond the sinus.
- b. Petiole scales brown, essentially concolorous (often with margins a paler brown); petiole scurf (minute squamulae) dark brown; pinnules rarely stalked, or stalks on a few proximal ones to 1 mm. *C. fulva*.
- b. Petiole scales bicolorous (dark brown with broad to narrow, whitish margins); petiole scurf (minute squamulae) tawny to whitish or bicolorous; pinnules on the proximal third of larger pinnae short-stalked (2-6 mm.). . . . *C. tuerckheimii*.

Cyathea fulva (Mart. & Gal.) Fée, Mém. Fam. Foug. 9: 34. 1857 (not *C. fulva* Sod. 1883). *Alsophila fulva* Mart. & Gal. Nouv. Mém. Acad. Roy. Sci. Bruxelles 15: 78, t.23. 1842 (type from Oaxaca, Mexico, *Galeotti* 6346). *C. furfuracea* Christ, Bull. Herb. Boissier II. 4: 950. 1904 (not *C. furfuracea* Baker, 1874). *C. onusta* Christ, *loc. cit.* *C. conspersa* Christ, *op. cit.* 5: 260. 1905. *C. underwoodii* Christ, *op. cit.* 6: 183. 1906. *C. delicatula* Maxon, Contr. U.S. Natl. Herb. 13: 4. 1909 (type from Alta Verapaz, between Tactic & Cobán, *Tuerckheim II-1629*). *C. mollis* Rosenst. in Fedde, Repert. Spec. Nov. Regni Veg. 22: 2. 1925 (not *C. mollis* Copel. 1917).

On wooded slopes and in ravines, in mountain forest, 900-3,300 m. Alta Verapaz; El Progreso; Quezaltenango; San Marcos; Zacapa. Southern Mexico; Honduras; Nicaragua; Costa Rica; Panama; Colombia; Venezuela.

Stem to 5 m. tall; leaves to 3 m. long; petiole light or dark brown, darkest at base, armed with stout, non-squamine spines to 0.5 cm. long, or becoming aculeate or muricate near the blade, essentially glabrous, but bearing abundant, appressed scales at base, these lanceolate or linear-lanceolate, to 3 cm. long, dark brown, essentially concolorous, often interspersed with brownish squamulae (scurf); lamina bipinnate-pinnatisect, the tissue glabrous; rachis light brown or yellow-brown, smooth to muricate, or aculeate on lower portion, scales essentially lacking, glabrous abaxially, minute-strigose adaxially and often brown-scurfy abaxially at pinna

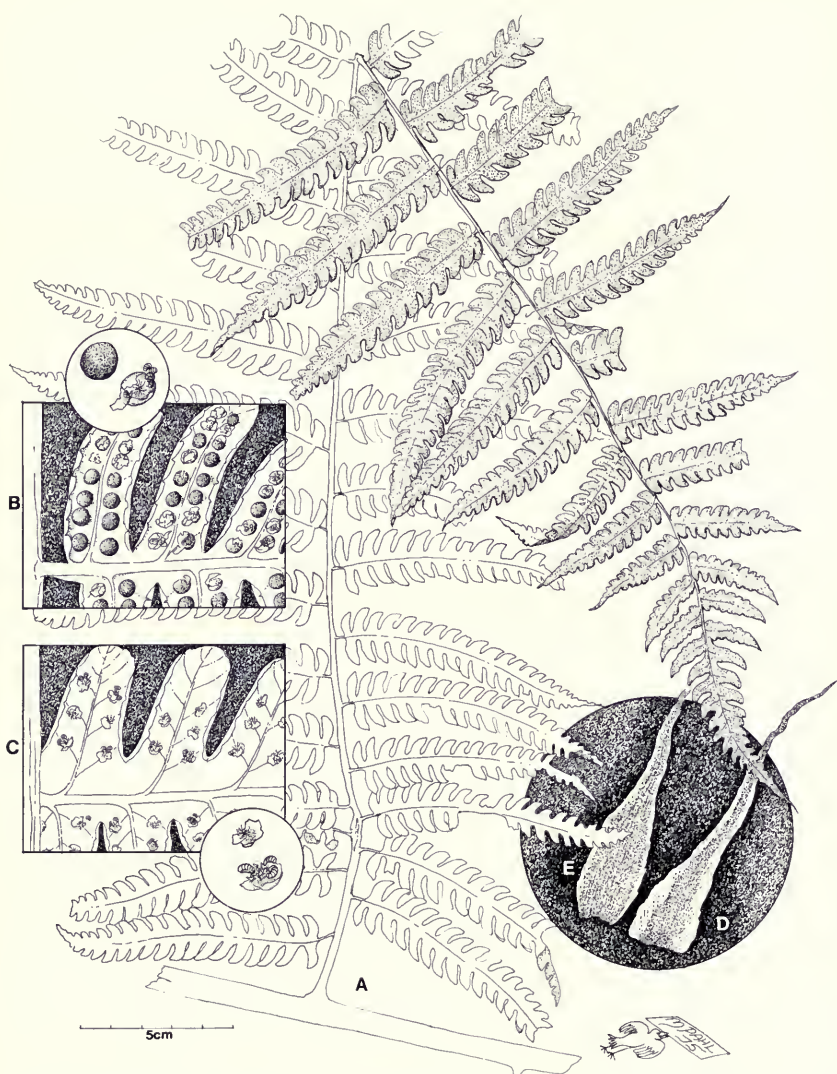


FIG. 20. *Cyathea*. a-b, *C. tuerckheimii*: a, habit, $\times \frac{1}{2}$; b, ultimate segments, $\times 3$, with inset, showing closed and open indusia, greatly enlarged; c, *C. multiflora*, ultimate segments, $\times 3$, with inset, showing indusia, greatly enlarged, with and without sporangia; d, *C. tuerckheimii*, bicolourous petiole scale, $\times 2\frac{1}{2}$; e, *C. fulva*, concolorous petiole scale, $\times 2\frac{1}{2}$.

bases; pinnae mostly sessile, or a few of the basal ones short-stalked (to 1.5 cm.), lanceolate, acuminate; pinnules sessile or subsessile (on largest pinnae rarely a few short-stalked), incised nearly to the costule; costae and costules densely but minutely strigose adaxially, glabrous or sparsely strigose abaxially, scales of the costules flat, dull brown, rather abundant or (in ours) scattered or lacking; ultimate segments subfalcate, 2-3 times as long as broad beyond the sinus, subentire to crenulate or crenate-serrate, plane or somewhat revolute, obtuse to subacute, midribs sparsely strigose, provided abaxially with brownish, acuminate, bullate or subbullate scales; veins simple or (more commonly) once-forked, glabrous or sparsely strigose adaxially; sori borne at or near the vein fork, inframedial between midrib and segment margin; indusium globose, becoming broadly lacerate and irregularly cup-shaped to somewhat flattened at maturity; receptacle subglobose or elongate; paraphyses about as long as or shorter than the sporangia.

The key characters of petiole scales and scurf, which are effectively used to separate this species from *Cyathea tuerckheimii*, may be frequently lacking on herbarium sheets (tree fern collections are typically fragmentary and often consist of only one or two pinnae) and the other key character (pinnules stalked or sessile) is not consistently reliable. However, the same kind of scurf present on the petiole may be often found also on the abaxial side of the rachis, around the base of the pinna stalks, and sometimes on the stalks themselves. That of *C. fulva* is dark and dull brown, while that of *C. tuerckheimii* is tawny to whitish, or bicolorous.

Cyathea multiflora J. E. Sm. Mem. Acad. Roy. Sci. (Turin) 5: 416. 1793. *Hemitelia multiflora* (J. E. Sm.) R. Br. Spreng. Syst. Veg. 4: 126. 1827. *Alsophila multiflora* (J. E. Sm.) Presl, Tent. Pterid. 61. 1836. *H. nigricans* Presl, Epim. Bot. 31. 1849.

In dense, wet forest, on wet slopes and stream banks, 40-900 m. Alta Verapaz; Izabal. British Honduras; Honduras; Nicaragua to Colombia; Ecuador; Peru; Bolivia.

Stem to 5 m. tall (in ours to 2 m.); leaves to 2 m. long; petiole light brown, sparsely to densely strigose, or glabrescent, armed with stout spines to 5 mm. long, and toward the base provided with appressed scales to 2 cm. long, these commonly lanceolate, attenuate, dark brown, often with paler margins; lamina bipinnate-pinnatisect, the tissue (in ours) glabrous, firm papyraceous; rachis dark brown to yellow-brown, aculeate to muricate, or smooth on the distal portion, scales essentially lacking, strigose, or glabrescent abaxially; pinnae subsessile or (especially the more proximal ones) short-stalked, elliptic to oblanceolate, abruptly acuminate; pinnules sessile or subsessile; costae with minute, brown scales, few and widely scattered or lacking, rather densely strigose adaxially, and densely to sparsely strigose or pilose or glabrescent abaxially; costules densely strigose adaxially, provided with flat or bullate, attenuate, brown (in ours) scales abaxially; ultimate segments straight or slightly falcate, 1.5 (2) times as long as broad, beyond the sinus, subentire to broadly dentate or crenate, plane or somewhat revolute, the apices rounded or truncate,

midribs glabrescent or bearing several stout, rigid trichomes adaxially, sometimes with a few bullate scales abaxially; veins simple or once-forked; sori borne on the veins, medial to supramedial between midrib and segment margin; indusium hemitelioid, subtending and partly encircling the sorus on the proximal side, flattened or curving upward around the sorus, subentire or deeply lacerate, often fugacious at maturity; receptacle subglobose; paraphyses about as long as the sporangia.

Cyathea multiflora varies considerably throughout its range, especially outside of Guatemala. In our area it is a relatively small tree fern, with a trunk usually less than 2 m. long, growing chiefly at lower elevations; but in South America it has been often found above 2,000 m. and with trunks up to 5 m. long. In Guatemala the trichomes on costule and midrib are brownish, and the tissue is glabrous, yet some specimens, from Costa Rica to South America, have whitish pinnule indument, and the tissue sparsely and minutely pilose on the abaxial side. The petiole scales of *C. multiflora* in Guatemala are brown and essentially concolorous, but in Colombia they are often bicolorous (brown with whitish margins) much like the scales of *Cnemidaria*.

***Cyathea tuerckheimii* Maxon, Contr. U.S. Natl. Herb. 13: 4. 1909** (type from Guatemala, without location, 1907, *Tuerckheim II-1645*).

In and at edges of wet forests, on slopes and in ravines, 1,300-3,000 m. Alta Verapaz; Baja Verapaz; Huehuetenango; Jalapa; Quezaltenango; El Quiché; San Marcos; Zacapa. Southern Mexico.

Stem to 8 m. tall; leaves to 3 m. long; petiole dark brown or olive-brown to stramineous, darkest at base, armed with stout spines to 0.4 cm. long, or becoming aculeate or muricate near the blade, essentially glabrous, but bearing abundant, appressed scales at base, these lanceolate or linear-lanceolate, to 3 cm. long, dark brown, mostly with whitish margins, and often interspersed with minute, whitish, tawny or bicolorous squamulae (scurf); lamina bipinnate-pinnatisect, the tissue glabrous; rachis dark brown to yellow-brown or stramineous, muricate, or aculeate on lower portion, scales essentially lacking, glabrous abaxially, minute-strigose adaxially and often pale-scurfy abaxially at pinna bases; pinnae short-stalked (1-3 cm.), or the more distal ones subsessile, deltoid-lanceolate, short-acuminate; pinnules subsessile to short-stalked, those of the proximal third of larger pinnae with stalks 2-6 cm. long, incised nearly to the costule; costae and costules densely but minutely strigose adaxially, essentially glabrous abaxially, or the costules with a few, scattered, brown, flat or sub-bullate scales; ultimate segments falcate or subfalcate, 2-3 times as long as broad beyond the sinus, crenulate to crenate-serrate, slightly revolute, obtuse to subacute, midribs sparsely strigose or glabrescent, provided abaxially with brownish, acuminate, bullate or sub-bullate scales; veins commonly once-forked, or some of them simple (or on a few plants 1- to 3-forked), glabrous, or sparsely strigose adaxially; sori commonly borne at the vein fork, inframedial between midrib and segment margin; indusium globose, becoming broadly lacerate and irregularly cup-shaped at maturity; receptacle subglobose or elongate; paraphyses shorter than the sporangia.

This and *Cyathea divergens* Kunze, from South America and southern Central America are easily confused. Pinnae of the latter are generally long-stalked, and pinnules are long-stalked and tapered from near the base. Pinnae of *C. tuerckheimii* are short-stalked, with the pinnules sessile to short-stalked and commonly tapered from about the middle. Rolla Tryon, who is currently preparing a monographic study of *Cyathea*, has stated (pers. comm.) that the two taxa probably do not merit more than varietal distinction.

LOPHOSORIA Presl

Plants acaulescent or with erect stems, massive and trunklike, to 1 m. tall; leaves to several meters long, completely lacking scales; petiole to 1.5 m. long, light or dark brown, often blackish at very base, smooth, unarmed, densely lanate at base with brownish or rusty, septate trichomes; lamina subcoriaceous, commonly subdeltoid, tripinnate to tripinnate-pinnatisect, pale to dark green above, commonly glaucous beneath; rachis light brown or stramineous, villous or glabrescent; pinnae stalked, broadly lanceolate to subdeltoid, the costae and costules villous (often densely so) above and beneath with pale to dark brown trichomes; pinnules stalked, commonly bearing 18-24 pairs of segments; ultimate segments incised halfway or nearly quite to the midrib, the latter densely villous beneath (at least the proximal half), but glabrous above; veins free, pinnately branched in each lobe, the tips of veinlets reaching the margin at a point well above the sinus; sori one to a vein, borne on the basal, acroscopic branch, each containing 6-10 sporangia; receptacle scarcely elevated; paraphyses about as long as the sporangia; indusia lacking; spores 64 per sporangium, whitish to pale yellow, globose-tetrahedral, encircled by a thickened, uninterrupted, equatorial rim, laesura prominent, surface sparsely dotted with minute apertures, perine lacking.

Lophosoria is generally considered the most primitive genus in the family. It is confined to the neotropics and contains a single species.

Lophosoria quadripinnata (Gmel.) C. Chr. in Skottsbl., Nat. Hist. Juan Fern. East. Islands 2: 16. 1920. *Polypodium quadripinnatum* Gmel. Syst. Nat. 2 (2): 1314. 1791. *P. pruinatum* Sw. J. Bot. (Schrad.) 1800 (2): 29. 1801. *Alsophila pruinata* (Sw.) Kaulf. in Kunze, Linnaea 9: 99. 1834. *Lophosoria pruinata* (Sw.) Presl, Abh. Böhm. Ges. Wiss. V. 5: 345. 1848. *Alsophila quadripinnata* (Gmel.) C. Chr. Index Fil. 47. 1905.

Open hillsides, road cuts, and in wooded ravines and along streams in deep forests, 1,500-3,800 m. Huehuetenango; El Progreso; Quezaltenango; San Marcos; Sololá; Zacapa. Southern Mexico; Greater Antilles; Colombia and Venezuela to Brazil and Bolivia; Southern Chile; Juan Fernandez Islands.



FIG. 21. *Lophosoria quadripinnata*. a, habit, $\times \frac{1}{2}$; b, ultimate segments, $\times 2$; c, portion of ultimate segment, showing rigid trichomes and lax paraphyses, $\times 8$.

Characters are those of the genus.

Lophosoria quadripinnata is abundant in regions in which it occurs. Scales and indusia are totally lacking, and the highly dissected leaves are often glaucous beneath, the white or silvery color (especially on live plants) markedly contrasting with the dark green adaxial surface. No other tree fern possesses this combination of characters.

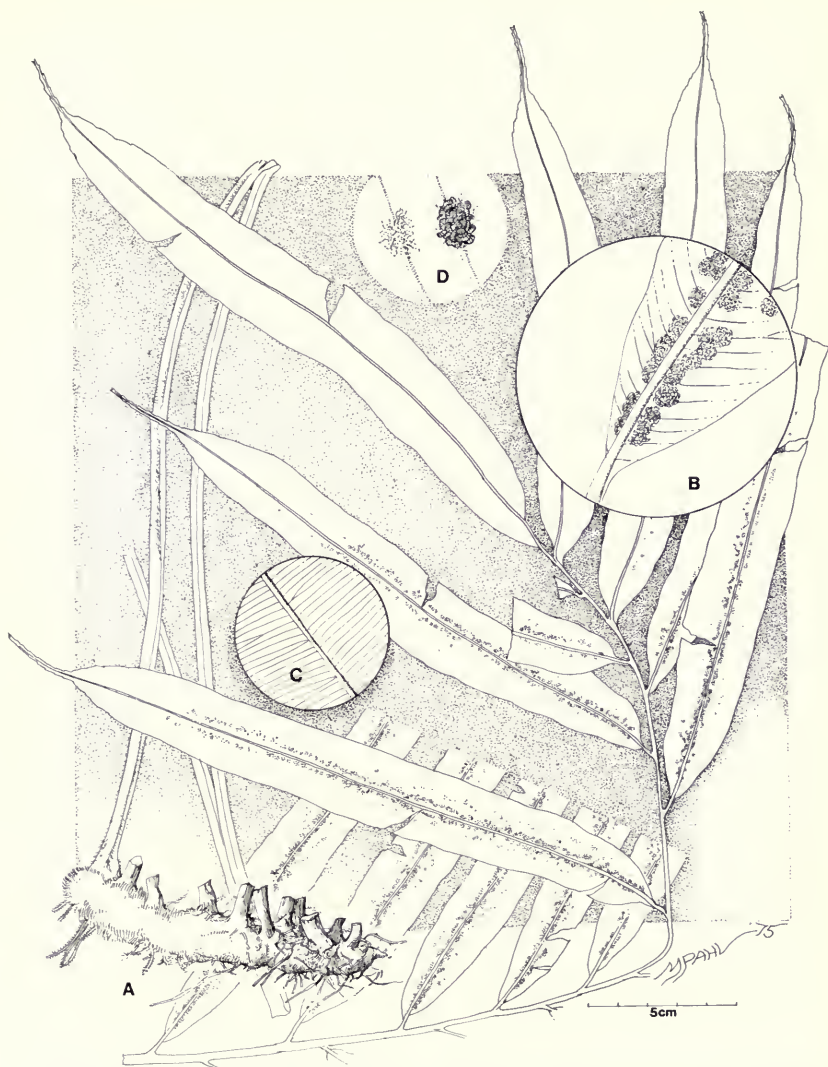


FIG. 22. *Metaxya rostrata*. a, habit, $\times \frac{1}{2}$; b, base of pinna, $\times 2$; c, portion of pinna, showing venation, $\times 1\frac{1}{2}$; d, sori, one with sporangia removed, greatly enlarged.

METAXYA Presl

Plants erect from stout, creeping rhizomes which are densely provided with filiform, septate, yellowish to orange trichomes; leaves to several meters long, completely lacking scales; petiole to nearly 1 m. long, light brown or stramineous, smooth, unarmed, essentially glabrous; lamina chartaceous, simply pinnate, with apical segment similar in shape and size to the lateral pinnae; rachis with scattered

brown trichomes or glabrescent; pinnae stalked, narrowly lanceolate, with margin cartilaginous, entire, but coarsely dentate at the acuminate apices, glabrous above, sparsely pilose along costae beneath; veins free, simple or sometimes forked at or near the base, spreading from the costa at broad angles; sori 1-3 to a vein, crowding the costa, each bearing numerous sporangia; receptacle flat; paraphyses commonly longer than the sporangia; indusia lacking; spores 64 per sporangium, yellowish brown, tetrahedral, with prominent laesura, without apertures, perine present, essentially smooth.

Metaxya is found at low elevations in the American tropics and consists of a single species.

Metaxya rostrata (HBK.) Presl, Tent. Pterid. 60. 1836. *Polypodium rostratum* Willd. Sp. Pl. 5: 193. 1810 (not *P. rostratum* Burm. 1768). *Aspidium rostratum* HBK. Nov. Gen & Sp. 1: 12. 1815 (*nom. nov.*). *Amphidesmium rostratum* (Willd.) J. Sm. J. Bot. (Hooker) 1: 201. 1842. *Alsophila blechnoides* (Rich.) Hook. Sp. Fil. 1: 35. 1844.

In ravines and along streams in forests, 40-300 m. Izabal. British Honduras; Honduras; Nicaragua; Costa Rica; Panama; Trinidad; Lesser Antilles; northern South America southward to Brazil and Bolivia.

Characters are those of the genus.

Within the Cyatheaceae, no other species has widely spaced petioles borne on a long-creeping rhizome. This, and the simply pinnate, non-squamate leaves, easily separates *Metaxya rostrata* from all other species in the family.

NEPHELEA Tryon

Reference: Gerald J. Gastony, A revision of the fern genus *Nephelea*, Contr. Gray Herb. 203: 81-148. 1973.

Stem erect, commonly massive and trunklike (in ours to 10 m. tall), provided with stout, blackish spines and (especially near the apex) large scales; unexpanded croziers densely scaly and bearing stout, blackish, squaminate spines; leaves to several meters long; petiole variously colored (but not blackish), provided with stout, blackish, squaminate, mostly obturbinate spines often to 1.5 cm. long, and with large, spreading scales which are commonly dark-colored, often with paler margins, the marginal cells differentiated from those of the central portion in shape, size and orientation, and with a dark apical seta and often some smaller lateral ones; lamina bipinnate to tripinnatifid (in ours bipinnate-pinnatifid), the axes bearing abundant, appressed, minute, recurved trichomes on the adaxial side; rachis brownish, glabrous abaxially, or provided adaxially with scattered to abundant, spreading scales and often with appressed, setose squamulae; pinnae sessile to stalked, the axes and midribs commonly bearing flat or bullate scales abaxially; veins free,



FIG. 23. *Nephelea*. a-d, *N. mexicana*: a, habit, $\times \frac{1}{2}$; b, ultimate segments, $\times 6$; c, petiole scales, greatly enlarged; d, petiole spines, greatly enlarged; e, *N. tryoniana*, ultimate segments, $\times 6$, with bullate scales, greatly enlarged.

simple or branched, in lobed segments the basal veins reaching the margin at a point above the base of the sinus; sori disposed on the veins near the midrib, on branched veins situated at the fork; indusium hemitelioid, menisoid, sphaeropteroid, or lacking; receptacle globose to elongate, and with paraphyses commonly inconspicuous, shorter than the sporangia; spores 16 per sporangium, exine without apertures of various size, lacking a single large equatorial pore near the center of each face, perine provided with long, irregular ridges or folds.

Next to *Cnemidaria* this is perhaps the most distinctive of the squamate genera in the Cyatheaceae. The petioles and young croziers are abundantly beset with stout, blackish, commonly obturbinate spines. These spines are squaminate, i.e., small spines bear the same kind of differentiated marginal cells as do the scales. Although these scaly portions are often caducous, at least some remnants may be observed at the thickened bases of spines. Other genera include some species with spiny petioles, but the spines are not squaminate nor obturbinate. Petiole scales in *Nephelea* are slender and spreading. Only *Sphaeropteris* has some species with spreading scales, whereas in all other squamate genera the petiole scales are commonly broad and appressed.

Nephelea is most closely related to *Alsophila*. Among the genera of Cyatheaceae, only *Alsophila*, *Nephelea*, and some species of *Sphaeropteris* bear setose scales. Gastony (Amer. J. Bot. 61: 672-680. 1974) has found that most species of *Alsophila* and all of *Nephelea* have sporangia bearing 16 spores, whereas the rest of the family typically has 64-spored sporangia. He also points out that spore perine in *Alsophila-Nephelea* is characterized by long, irregular ridges. Other genera apparently have spore perine lacking this type of ornamentation, or the perine lacking entirely.

Nephelea is a neotropical genus composed of 18 species which occur principally in cloud forests. Two species are found in Guatemala.

- a. Costules and midribs with whitish, bullate scales abaxially; indusium lacking *N. tryoniana*.
- a. Costules and midribs lacking bullate scales (some flat ones often present on costules); indusium subglobose (although often fugacious and vestigial on mature plants) *N. mexicana*.

Nephelea mexicana (Schlecht. & Cham.) Tryon, Contr. Gray Herb. 200: 40. 1970. *Cyathea mexicana* Schlecht. & Cham. Linnaea 5: 616. 1830. *C. patellaris* Christ, Annuaire Conserv. Jard. Bot. Genève 4: 207. 1900. *Nephelea patellaris* (Christ) Tryon, Contr. Gray Herb. 200: 40. 1970. *Alsophila costalis* Christ, Bull. Herb. Boissier II. 4: 951. 1904. *Cyathea costalis* (Christ) Domin, Pteridophyta 262. 1929. *Alsophila tenerifrons* Christ, Bull. Herb. Boissier II. 4: 959. 1904. *Cyathea tenerifrons* (Christ) Domin, Pteridophyta 263. 1929. *Nephelea tenerifrons* (Christ) Tryon, Contr. Gray Herb. 200: 40. 1970. *Cyathea gemmifera* Christ, in Jiménez, Bol. Fomento (San José) 3: 661. 1913. *Palma de montaña* (fide Steyermark, Quezaltenango).

In forests, on slopes and in ravines, 200-2,800 m.; Alta Verapaz; Baja Verapaz; Huehuetenango; Izabal; Quezaltenango; San Marcos; Suchitepéquez. Mexico; Honduras and El Salvador south to Panama; Ecuador.

Stem to 10 m. tall, beset with blackish spines and dark brown scales, especially near the apex; leaves to 4 m. long; petiole about 1 m. long, light to dark brown, abundantly provided with stout, blackish spines (to about 1 cm. long), especially toward the base, and also provided with scattered, slender, spreading, brown to bicolorous scales, in addition to a dense covering of minute (ca. 0.1 mm.) brown, appressed squamulae; lamina commonly bipinnate-pinnatifid, the tissue chartaceous to subcoriaceous, glabrous, abruptly terminating in a pinna-like apex; rachis brown, with larger scales essentially lacking, but with appressed, minute squamulae often abundant on abaxial side, and with appressed, minute, recurved trichomes on adaxial side, or rachis often glabrescent distally; pinnae sessile to short-stalked, broadly lanceolate, the costae and costules rather abundantly provided abaxially with appressed, minute squamulae, and adaxially with minute, recurved, brown trichomes, the costae also with scattered, whitish scales to 1 mm. long, abaxially; pinnules commonly deeply pinnatisect; ultimate segments subentire or crenate-seriate, lacking bullate scales; veins simple to forked; sori crowding the midrib, often at the vein forks; indusium subsphaeropteroid, irregularly cup-shaped at maturity, or commonly breaking apart at maturity so that merely a remnant is attached to the receptacle; receptacle globose or subglobose; paraphyses usually shorter than the sporangia.

Nephelea tryoniana Gastony, Contr. Gray Herb. 203: 118. 1973.

Wet, mixed mountain forests, 1,500-2,500 m. Alta Verapaz; Zaca-pa (type from Río Lima, Sierra de las Minas, *Steyermark 30009*). Honduras; Nicaragua.

Stem to 4.5 m. tall, densely provided with stout blackish spines and dark brown to blackish scales (especially near apex); leaves to about 2 m. long; petiole to 0.4 m. long, light to dark brown, abundantly provided with stout, blackish spines to ca. 1 cm. long (especially on the lower portions), becoming muricate toward base of lamina, and also provided with long (to 2 cm.) slender, spreading, pale to brown, often bicolorous scales, in addition to a rather dense covering of minute (ca. 0.1 mm.), pale to brown, appressed squamulae; lamina commonly bipinnate-pinnatifid, the tissue papyraceous, glabrous, rather gradually reduced to an acute apex; rachis light brown, provided on both sides with abundant, long scales as on the petiole, and abaxially with appressed, minute squamulae, adaxially with appressed, minute, recurved trichomes; pinnae sessile or subsessile, narrow-ovate to lanceolate, the costae scaly as on the rachis, and adaxially with appressed, minute, recurved trichomes; pinnules commonly deeply pinnatisect, the costules densely covered adaxially with recurved trichomes, abaxially with flat, whitish scales, these bullate in the distal portion; ultimate segments slender, subentire, spreading at broad angles from the costule, the midribs sparsely strigose, and often with whitish, bullate scales distally; veins simple to (more commonly) once-forked; sori commonly at the forks of veins and inframedial between midrib and margin; receptacle elongate or subglobose; paraphyses usually shorter than the sporangia; indusium lacking.

In addition to the characters used in the key, *Nephelea tryoniana* can also be distinguished from *N. mexicana* by the abundance of long scales borne on the rachis. In *N. mexicana* the rachis often may be provided with minute, setose squamulae, but the long, conspicuous scales (as on the lower petiole) are sparse or lacking.

SPHAEROPTERIS Bernhardt

Reference: R. M. Tryon, The American tree ferns allied to *Sphaeropteris horrida*, *Rhodora* 73: 1-19. 1971.

Stem erect, commonly massive and trunklike; leaves to several meters long; petiole smooth to muricate (in ours) or provided with nonsquaminate spines (the spines not bearing scale-like remnants along their margins or at their bases), scales commonly spreading or rarely somewhat appressed abaxially, structurally conform, the marginal cells similar to those of the central portion in shape, size orientation, and usually bearing apical and marginal setae; lamina typically bipinnate or more highly dissected, in a few species simply pinnate (in ours bipinnate-pinnatisect to subtripinnate), the axes variously provided with scales and trichomes abaxially, and (especially on costae and costules) with minute, recurved trichomes on the adaxial side; veins free, simple or branched, in lobed segments the basal veins reaching the margin at a point above the base of the sinus; indusium hemitelioid to globose, or lacking; spores 64 per sporangium, with or without apertures of various size, but lacking a single, large, equatorial pore near the center of each face, commonly (as in ours) with perine.

This tropical genus contains over 100 species, with a large majority in the Old World. Most of the neotropical species occur in South America, and only the following two have been found in Guatemala.

- a. Indusium nearly globose, cup-shaped at maturity; most petiole scales whitish or tawny, with dark-colored setae; rachis and costae abundantly and conspicuously scaly *S. horrida*.
- a. Indusium lacking; petiole scales lustrous brown, with setae commonly concolorous; rachis and costae with scales sparse and inconspicuous or lacking *S. myosuroides*.

Sphaeropteris horrida (Liebm.) Tryon, *Contr. Gray Herb.* 200: 20. 1970. *Cibotium horridum* Liebm. *Kongel. Danske Vidensk. Selsk. Skr. V. 1:* 279. 1849 (not *Cyathea horrida* (L.) J. E. Sm. 1793). *Cyathea princeps* E. Mayer, *Gartenfl.* 17: 10: 1868. *C. bourgaei* Fourn. *Mex. Pl.* 1: 135. 1872. *C. glauca* Fourn. *loc. cit.* *C. munchii* Christ, *Bull. Herb. Boissier* II. 7: 413. 1907.

In forests and damp thickets, along rivers and on sides of ravines, sometimes found on open banks, 500-2,000 m. Alta Verapaz; Baja Verapaz; Chiquimula; Huehuetenango; Quezaltenango; Suchitepé-

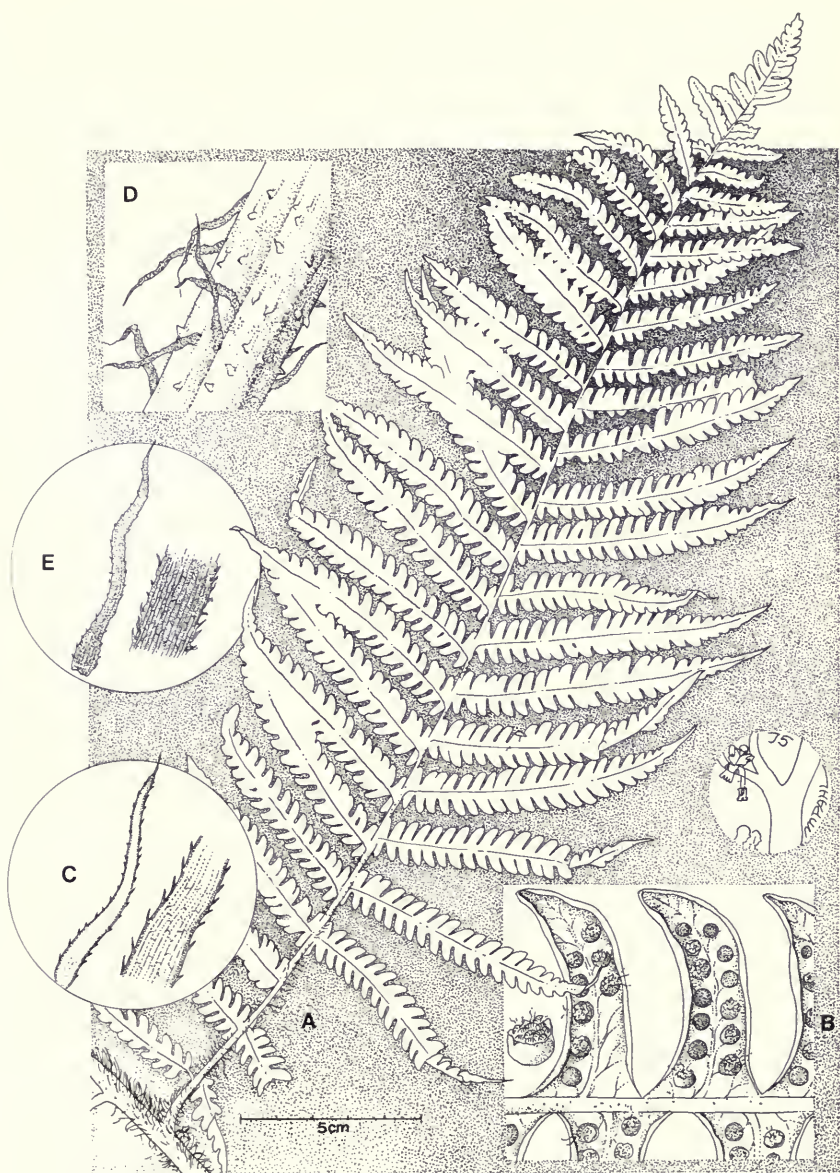


FIG. 24. *Sphaeropteris*. a-c, *S. horrida*: a, pinna, habit, $\times \frac{1}{2}$; b, ultimate segments, $\times 5$, with one sorus greatly enlarged; c, petiole scales, greatly enlarged; d-e, *S. myosuroides*: d, portion of petiole, $\times 1\frac{1}{2}$; e, petiole scales, greatly enlarged.

quez. Southern Mexico; Honduras. *Palma de montaña*; *palmita* (fide Standley, Quezaltenango).

Stem to 15 m. tall and 40 cm. in diameter; leaves to 5 m. long; petiole light to dark brown, muricate with the persistent bases of scales, the scales abundant (especially on the lower petiole), appressed or, more commonly, spreading, to 3 cm. long, linear, most of them whitish to tawny, with rigid, dark, apical and lateral setae, trichomes lacking; lamina bipinnate-pinnatisect to subtripinnate, the tissue glabrous, chartaceous to subcoriaceous, somewhat glaucous beneath; rachis brown or stramineous, muricate, abundantly scaly, trichomes essentially lacking, or somewhat villous on the distal portion adaxially; costae abundantly scaly abaxially, appressed-villous adaxially, costules glabrous or with a few filiform scales abaxially, abundantly provided with minute, recurved trichomes adaxially; pinnules sessile, narrow-oblong, cut nearly (or rarely, quite) to the base; ultimate segments subfalcate, obtuse to subacute, entire to crenulate, with slightly revolute margins, glabrous or the midribs beneath with scattered, pale trichomes or filiform scales; veins once- or twice-forked; sori commonly borne at the vein fork, crowding the midrib; indusium nearly globose, rupturing apically at maturity but the base persistent, conspicuous, cup-shaped; receptacle subglobose or elongated, the paraphyses relatively short and inconspicuous; spores brownish, tetrahedral, surface essentially smooth, without apertures.

Of all the American species in the family, plants of *Sphaeropteris horrida* are among the largest and most striking. The stout trunk bears a handsome crown of huge, spreading leaves which are supported by massive, scaly petioles. In Quezaltenango, the trunks are reportedly used in the construction of houses. In Mexico the fern is often called "rabo de mico."

Sphaeropteris myosuroides (Liebm.) Tryon, Contr. Gray Herb. 200: 20. 1970. *Alsophila myosuroides* Liebm. Kongel. Danske Vidensk. Selsk. Srk. V. 1: 286. 1849 (type from Chinantla, Oaxaca, Mexico, *Liebmann s.n.*, 1842).

In open woods, on slopes and along streams, sea level to 400 m. Alta Verapaz; Izabal; Petén. Cuba; Southern Mexico; British Honduras; Honduras; Nicaragua.

Stem to 3 m. tall, sometimes aculeate toward apex; leaves to 2.5 m. long; petiole to 1 m. long, light or dark brown, or stramineous, darkest at base, densely aculeate, or muricate toward apex, provided with abundant, appressed, minute trichomes, scales abundant near the base, linear, to 3 cm. long, bright shiny-brown, setose; lamina bipinnate-pinnatisect to subtripinnate, ovate, the tissue glabrous, chartaceous; rachis light or grayish brown or stramineous, muricate, rather densely though minutely strigose with terete, recurved trichomes, scales essentially lacking; pinnae stalked, costae and costules strigose, densely so on the adaxial side, with scales lacking, or widely scattered on the costae abaxially; pinnules subsessile to short-stalked, lanceolate to oblong, cut nearly or quite to the base; ultimate segments subfalcate, subacute, crenate-serrate, with slightly revolute margins, glabrous or the

midribs beneath sparsely provided with pale trichomes and a few scattered, brown scales; veins once or twice forked; sori medial to inframedial, borne at or slightly above the vein forks; indusium lacking; receptacle small, subglobose or flattened, the paraphyses longer than the sporangia, conspicuous; spores brownish, tetrahedral, surface essentially smooth, without apertures.

This and *Sphaeropteris horrida* are quite distinct, separated easily by strong characters of indusia and scales. The latter is also a much larger plant, the trunks often attaining lengths of up to 15 m., whereas those of *S. myosuroides* do not exceed 3 m. Furthermore, *S. myosuroides* is a lowland fern, commonly growing at or near sea level and not found (at least in Guatemala) above 400 m. *S. horrida* prefers middle elevations, generally 1,000-1,500 m.

TRICHIPTERIS Presl

References: W. R. Maxon, The North American species of *Alsophila* grouped with *A. armata*, Contr. U.S. Natl. Herb. 24: 33-46. 1922. Ramón Riba, Revisión monografica del complejo *Alsophila swartziana* Martius (Cyatheaceae), Anales Inst. Biol. Univ. Nac. Mexico 38: 61-100. 1967.

Stem horizontal to erect, commonly massive and trunklike, leaves to several meters long; petiole smooth, muricate or provided with nonsquaminate spines (the spines not bearing scalelike remnants along their margins or at their bases), scales commonly appressed, brownish, or bicolorous, with pale or whitish margins, the marginal cells differentiated from those of the central portion in shape, size and orientation, lacking marginal setae (though sometimes with dark, marginal denticulations); lamina simply pinnate to tripinnate-pinnatifid (in ours pinnate-pinnatisect to subtripinnate-pinnatifid), the axes variously provided with scales and trichomes abaxially, and (especially on costae and costules) with minute, recurved, trichomes adaxially; veins free (rarely, outside our area, anastomosing), simple or branched, in lobed segments the basal veins reaching the margin at a point above the base of the sinus; indusium lacking; spores commonly 64 per sporangium, exine with or without apertures of various size, but lacking a single large, equatorial pore near the center of each face.

Although very closely related to *Cyathea* the species of *Trichipteris* comprise a separate evolutionary group, distinguished from the former by lack of an indusium. For further discussion see *Cyathea*.

The genus contains about 55 species, and is confined to the American tropics.

- a. Leaves pinnate-pinnatisect. *T. ursina*.
- a. Leaves bipinnate-pinnatifid or more complex.
 - b. Petiole scales abundant throughout, whitish; scales of secondary axes (costae) frequent, flat, whitish; petiole spines lacking. *T. mexicana*.

- b. Petiole scales abundant only at base (essentially lacking above), brown or bicolorous; scales of secondary axes (costae) lacking, or sparse, tawny to brown, flat to bullate; petiole spines abundant (except lacking in *T. costaricensis*).
- c. Costa and rachis abundantly spiny throughout *T. microdonta*.
- c. Costa unarmed (rarely muricate), rachis usually unarmed, at least in the distal portion.
- d. Ultimate segments subentire, broadly rounded at apex, 2 to 2½ times as long as broad; petiole scales dark brown, concolorous; sori medial to supra-medial between midrib and segment margin *T. schiedeana*.
- d. Ultimate segments crenate, serrate, or lobed, acute or subacute, 3½ to 5 times as long as broad; petiole scales bicolorous, brown with whitish margins; sori mostly inframedial between midrib and segment margin.
- e. Primary axis densely hirsute, sometimes scabrous with the persistent bases of trichomes *T. scabriuscula*.
- e. Primary axis glabrous or sparsely hirsute, the deciduous trichomes often leaving a dark scar but an essentially smooth surface.
- f. Sori subtended by narrowly attached squamulae (thus appearing indusiate); margins of petiole scales lacking dark denticulations; petiole unarmed; larger pinnae often stalked *T. costaricensis*.
- f. Sori lacking basal squamulae; margins of petiole scales with scattered or continuous dark denticulations (at least near scale apex); petiole spiny; pinnae sessile (or some basal ones short-stalked).
- g. Petiole scales dark brown, with narrow, whitish margins and tips, the margins (toward their apices) provided with abundant, often continuous, dark brown denticulations. Guatemala
T. pansamalana.
- g. Petiole scales whitish, each with a narrow, brown median stripe or with a dark spot at base, the margins provided with scattered, dark brown denticulations. Mexico *T. bicrenata*.

Trichipteris bicrenata (Liebm.) Tryon, Contr. Gray Herb. 200: 44. 1970. *Cyathea bicrenata* Liebm. Kongel. Danske Vidensk. Selsk. Skr. V. 1: 289. 1849 (type from near Totontepec, Oaxaca, Mexico, Liebm. s.n.). *Alsophila bicrenata* (Liebm.) Fourn. Mex. Pl. Crypt. 134. 1872.

In wet forests and thickets, 1,000-2,000 m. Known thus far only in southern Mexico, but since it has been collected in Chiapas it may be also expected in adjacent areas of Guatemala.

Stem to 10 m. tall; leaves to several meters long; petiole yellow-brown, glabrous or sparsely hirsute, abundantly provided with sharp, stout spines to 2.5 mm. long, but the surface otherwise smooth, with appressed scales at the base, these whitish to bicolorous (whitish with a narrow, dark median stripe), the margins with scattered dark brown denticulations; lamina bipinnate-pinnatisect or subtripinnate-pinnatifid, the tissue glabrous, thin-herbaceous; rachis spiny on the lower portion, hirsute or glabrescent, yellow-brown to stramineous, scales essentially lacking; pinnae sessile; costae lacking spines and scales, but abundantly provided with orange to light brown trichomes, appressed adaxially, spreading abaxially; pinnules sessile,

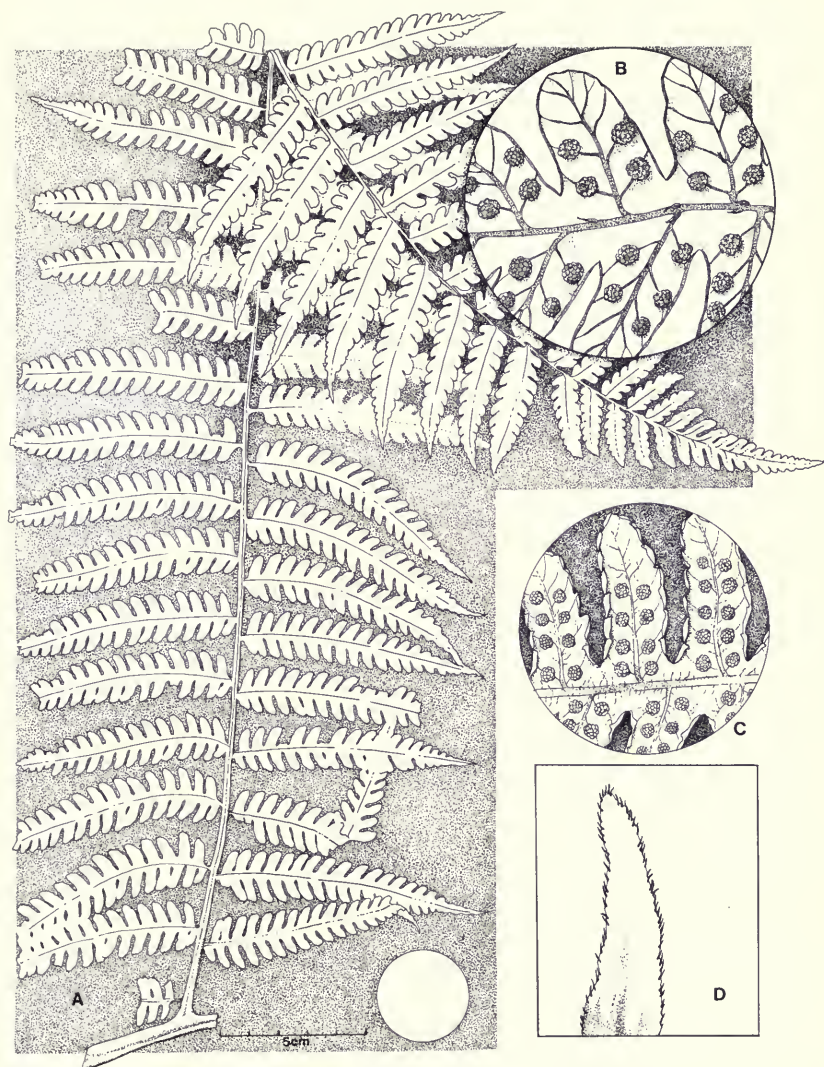


FIG. 25. *Trichipteris*. a-b, *T. schiedeana*: a, pinna, habit, $\times \frac{1}{2}$; b, ultimate segments, $\times 4\frac{1}{2}$; c, *T. scabriuscula*, ultimate segments, $\times 5$; d, *T. pansamalana*, tip of petiole scale, greatly enlarged.

cut nearly to the costule into linear, subfalcate segments, the sinuses acute to broadly angular; costules adaxially provided with tawny or light brown, mostly appressed trichomes, abaxially hirsute and with brownish, flat or bullate scales at least on proximal portions; ultimate segments deeply crenate-serrate or lobed, obtuse to subacute, the midribs sparsely strigose or glabrescent on the adaxial side, abaxially hirsute and provided with light brown or tawny, bullate scales near the bases of segments; veins once- or twice-forked in each segment lobe; sori commonly inframedial between midrib and segment margin; receptacle small, elongated to subglobose; paraphyses longer than the sporangia.

Trichipteris costaricensis (Kuhn) Barr., *Rhodora* 78: 1. 1976. *Hemitelia costaricensis* Mett. Ann. Sci. Nat. Bot. V. 2: 265. 1864 nom. nud. *H. costaricensis* Kuhn, *Linnaea* 36: 159. 1869. *Cyathea costaricensis* (Kuhn) Domin, *Acta Bot. Bohem.* 9: 107. 1930.

In forests, on mountain slopes, river banks and in ravines, also on open slopes and roadside banks, 600-1,500 m. Chiquimula; Escuintla; Quezaltenango; Retalhuleu; Santa Rosa. Mexico; Honduras and El Salvador to Panama.

Stem to 4 m. tall; leaves to several meters long; petiole yellow-brown, trichomes essentially lacking, unarmed (at least in our area), surface smooth, or minutely tuberculate, with appressed scales at base, these broad and bicolorous, whitish with dark brown median stripes or tips; lamina bipinnate-pinnatisect, the tissue glabrous, firm-herbaceous; rachis unarmed, essentially glabrous; pinnae short-stalked; costae lacking spines and scales, with light or dark brown minute, recurved trichomes adaxially, essentially glabrous abaxially; pinnules sessile or subsessile, cut nearly to the costule into narrow, subfalcate segments, the sinuses acute to narrowly rounded; costules provided adaxially with abundant light or dark brown, minute, recurved trichomes, abaxially glabrous or with scattered, lax, pale brown trichomes and scattered, broad, tawny or brownish, flat to sub-bullate scales; ultimate segments acute or subacute, crenulate to deeply crenate, the lobes often bidentate, the midribs with a few rigid trichomes adaxially, midrib and veins glabrescent or with rather abundant, whitish or pale brown, lax trichomes abaxially; veins once- or twice-forked; sori inframedial (rarely medial) between midrib and segment margin, subtended by one to a few membranaceous squamulae resembling indusial segments, these greatly narrowed and attached by a thin point at base, narrowed to a usually filamentous apex; receptacle subglobose; paraphyses about as long as the sporangia.

Trichipteris mexicana (Mart.) Tryon, *Contr. Gray Herb.* 200: 44. 1970. *Alsophila mexicana* Mart. *Icon. Pl. Crypt. Bras.* 70. t.45. 1834 (type from San Pablo de Teoxomulco, Oaxaca, Mexico, *Karwinsky s.n.*) (not *Cyathea mexicana* Schlecht. & Cham. 1830). *A. godmanii* Hook. in Hook. & Bak., *Syn. Fil.* 36. 1866.

Wet forests, in ravines and along streams, 800-1,800 m. Alta Verapaz (type from Cobán, *Godman & Salvin s.n.*); Huehuetenango; Quezaltenango; San Marcos. Southern Mexico; Honduras.

Stem to 10 m. tall; leaves to several meters long; petiole yellow-brown to stramineous, tuberculate to muricate, but lacking spines, densely whitish-hirsute and copiously provided with appressed, broad, flat scales, these white or very pale yellow, concolorous, or with a narrow, brown median stripe; lamina bipinnate-pinnatisect to subtripinnate-pinnatifid, the tissue glabrous, thin-herbaceous; rachis and costae light brown to stramineous, adaxially densely hirsute-strigose, abaxially hirsute with whitish, septate trichomes, or muricate with their persistent bases, abundantly provided with broad, flat, whitish to pale yellow scales; pinnae sessile or short-stalked; pinnules sessile, cut nearly to the costule into pinnatifid segments, the sinuses rather broadly rounded; costules adaxially provided with tawny or light brown, appressed trichomes, abaxially hirsute and with abundant whitish to tawny, broad and flat, or (more commonly) bullate scales; ultimate segments deeply crenate to pinnatifid, obtuse to subacute, the midribs on both sides with scattered, rigid trichomes, provided with scattered, whitish, bullate scales abaxially; veins commonly once- or twice-forked in each segment lobe; sori inframedial between midrib and segment margin, often confined to the proximal third of the segment; receptacle minute, subglobose; paraphyses few, as long as or slightly longer than the sporangia.

Trichipteris microdonta (Desv.) Tryon, Contr. Gray Herb. 200: 46. 1970. *Polypodium microdontum* Desv. Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. 5: 319. 1811. *Alsophila microdonta* (Desv.) Desv. Mem. Soc. Linn. Paris 6: 319. 1827. *A. armata* Mart. Icon. Pl. Crypt. Brasil 72, t.28. 1834 (not *A. armata* (Sw.) Presl. 1836). *Cyathea microdonta* (Desv.) Domin, Pteridophyta 263. 1929.

In wet forests and thickets, in swamps and along streams, sea level to 250 m. Alta Verapaz; Izabal. Southern Mexico; Honduras; Nicaragua; Costa Rica; Panama; Greater Antilles; Trinidad; Colombia; Venezuela; the Guianas; Brazil; Peru.

Stem to 4 m. tall, armed with stout spines; leaves to 2.5 m. long; petiole dark brown, with slender, conical, often curved spines to 1 cm. long, sparsely to moderately strigose to glabrescent, or provided with scurf composed of brownish squamulae, and toward the base with appressed scales to 1.5 cm. long, these commonly lanceolate, attenuate, dark brown, concolorous; lamina bipinnate-pinnatisect, tissue glabrous, firm membranaceous; rachis and costae dark brown to yellow-brown, provided throughout with distant, sharp spines, glabrous abaxially, minutely but often densely strigose adaxially, scales essentially lacking, or costae with a few scattered, brown, filiform scales; pinnae (except apical ones) stalked; pinnules sessile or subsessile, or some larger ones short-stalked, cut nearly to the costule into narrow segments; costules densely strigose adaxially, provided abaxially with pale to brown trichomes and minute, pale to brown, flat or sub-bullate scales; ultimate segments subfalcate, linear, 3.5-5 times as long as broad (larger ones 2-3 mm. wide), obtuse to subacute, margin crenulate to serrate, plane or slightly revolute, the si-

nuses acute or narrowly rounded, midribs with scattered, rigid trichomes on both sides, and with a few minute, brownish bullate scales abaxially; veins once-forked; sori borne at or near the vein fork, medial to inframedial between midrib and segment margin; receptacle minute, flattened; paraphyses flaccid, as long as or longer than the sporangia.

Trichipteris pansamalana (Maxon) Tryon, Contr. Gray Herb. 200: 44. 1970. *Alsophila pansamalana* Maxon, Contr. U.S. Natl. Herb. 24: 40. 1922.

At edges of forests, in ravines, along river banks, 900-2,800 m. Alta Verapaz (type from Pansamalá, *Tuerckheim* [J. D. Smith No. 1008]); Huehuetenango; Quezaltenango; San Marcos.

Stem to 3 m. tall; leaves to several meters long; petiole yellow-brown, glabrous, or sparsely hirsute on lower portion, abundantly provided with sharp, straight, stout spines to 4 mm. long, but the surface otherwise essentially smooth, with appressed scales at base, these bicolorous, with a broad, dark brown median stripe, the margins with abundant, dark denticulations which are often continuous (at least near the scale apex); lamina bipinnate-pinnatisect or subtripinnate-pinnatifid, the tissue glabrous, thin-herbaceous; rachis spiny on the lower portion, sparsely hirsute-strigose, or more densely so toward apex, scales lacking; pinnae sessile or the basal pair stalked; costae lacking spines and scales, but sparsely hirsute-strigose abaxially, more densely so adaxially; pinnules sessile, cut nearly to the costule into linear, subfalcate segments, the sinuses acute to rounded to squared; costules sparsely hirsute-strigose adaxially, pilose-strigose abaxially and with scattered, tawny, flattened or bullate scales; ultimate segments deeply crenate-serrate or lobed, obtuse to subacute, the midribs essentially glabrous on the adaxial side, but abaxially pilose-strigose and with scattered whitish or tawny bullate scales, especially near segment base; veins 1- to 3-forked; sori inframedial between midrib and segment margin; receptacle elongated to subglobose; paraphyses shorter than the sporangia.

Trichipteris scabriuscula (Maxon) Tryon, Contr. Gray Herb. 200: 44. 1970. *Alsophila scabriuscula* Maxon, Proc. Biol. Soc. Wash. 32: 125. 1919. *A. scabriuscula* var. *guatemalensis* Riba, Rhodora 69: 68. 1967 (type from Huehuetenango, *Steyermark* 49417).

Rich, wet forests, often along stream banks, sea level to 800 m. Alta Verapaz (type from Cubilguitz, *Tuerckheim* [J. D. Smith no. 7806]); Huehuetenango; Izabal. Southern Mexico; Honduras; Nicaragua.

Stem to 6 m. tall; leaves several meters long; petiole yellow-brown, abundantly pubescent, or scabrous with the persistent bases of trichomes, provided with many sharp, straight, conical spines to 8 mm. long; and with appressed scales at the base, these mostly bicolorous, dark brown with a narrow, whitish margin, the margin provided with a nearly continuous line of dark brown denticulations; lamina subtripinnate, the tissue glabrous, herbaceous; rachis yellow-brown to stramineous, aculeate

(at least on the lower portion), densely hirsute to scabrous as on the petiole, scales lacking; pinnae sessile; costae lacking spines and scales, but copiously hirsute; pinnules sessile, cut nearly to the costule into linear, subfalcate segments, the sinuses acute to quadrangular; costules densely hirsute, sparsely provided with tawny to dark brown, flat or sub-bullate scales on the abaxial side; ultimate segments crenate or with deep lobes (these often bidentate), obtuse to subacute, the midribs sparsely strigose or glabrescent on the adaxial side, abaxially hirsute and provided with widely scattered tawny, bullate scales; veins commonly once-forked; sori commonly inframedial between midrib and segment margin; receptacle small, elongated to subglobose; paraphyses longer than the sporangia.

In his revision, Riba recognizes two varieties of the species, with var. *guatemalensis* differing from the typical variety in its smaller leaf parts and in the acute to narrowly quadrangular (rather than broadly quadrangular) sinuses between the segments.

Trichipteris schiedeana (Presl) Tryon, Contr. Gray Herb. 200: 44. 1970. *Alsophila schiedeana* Presl, Tent. Pterid. 62. 1836. *Cyathea schiedeana* (Presl) Domin, Pteridophyta 263. 1929.

In dense forests and wet thickets, on slopes and along rivers and streams, 50-1,400 m. Alta Verapaz; Huehuetenango; Izabal; Quezaltenango; El Quiché. Southern Mexico; British Honduras; Honduras; El Salvador; Costa Rica; Panama. *Palma de montaña* (Quezaltenango, fide Steyermark).

Stem to 5 m. tall; leaves to 3 m. long; petiole gray- to yellow-brown, with sharp, straight, conical spines (to 8 mm. long) throughout, or merely muricate near the lamina, provided with scurf composed of brownish squamulae, occasionally sparsely strigose adaxially, and toward the base with appressed scales to 2 cm. long, these commonly lanceolate, attenuate, dark brown, concolorous (very rarely with a narrow, whitish margin); lamina bipinnate-pinnatisect, tissue glabrous, firm-membranaceous; rachis yellow-brown to stramineous, sharp-spiny to muricate, strigose (densely so adaxially) and often somewhat scurfy like the petiole, provided with scattered dark brown scales, many of these minute; pinnae sessile or some basal ones short-stalked; costae lacking spines or scurf, strigose (densely so adaxially), sparsely to abundantly provided with minute, dark brown scales abaxially; pinnules sessile, cut nearly to the costule; costules provided with abundant, dark brown, bullate scales, strigose adaxially, occasionally sparse-strigose abaxially; ultimate segments straight or subfalcate, oblong, 2-2.5 times as long as broad (larger ones 3-4.5 mm. wide), with broadly rounded apices, margins commonly subentire (sometimes crenulate), essentially plane, the sinuses acute, midribs with a few dark brown, bullate scales abaxially; veins simple to once-forked; sori borne at or near the vein fork, medial to supramedial between midrib and segment margin; receptacle small, subglobose; paraphyses much shorter than the sporangia.

Trichipteris ursina (Maxon) Tryon, Contr. Gray Herb. 200: 44. 1970. *Alsophila ursina* Maxon, J. Wash. Acad. Sci. 34: 48. 1944 (type from Stann Creek Valley, British Honduras, *Gentle 3197*).

In deep forests, sea level to 100 m. British Honduras; Nicaragua; Costa Rica.

Stem short, to 15 cm. long; leaves to 1.5 m. long and 0.25 m. broad; petiole to 25 cm. long, brown, densely covered with spreading scales, these to 2 cm. long, lanceolate, attenuate, dark, lustrous brown, concolorous or with narrow white margins; lamina pinnate-pinnatisect, tissue glabrous, firm-membranaceous to chartaceous; rachis densely scaly throughout (and thickly strigose, but trichomes obscured by the scales), the scales similar to those of the petiole, but becoming filiform and less abundant toward the apex; pinnae sessile (or basal ones short-stalked), spreading at broad angles from the rachis, incised nearly to the costa; costae provided with dark brown, filiform scales (these often sub-bullate abaxially) and with abundant, stiff, appressed, pale trichomes adaxially; ultimate segments oblong, subfalcate, broadly rounded at apex, the margins subentire to crenulate, plane or slightly undulate, glabrous, or thinly minute-pilose on midrib and veins abaxially; veins simple or, more commonly, once-forked; sori medial to supramedial between midrib and margin, on branched veins borne at or near the fork; receptacle flattened; paraphyses shorter than the sporangia.

Trichipteris ursina is known only from the type (British Honduras) and a few collections in Nicaragua and Costa Rica. It is one of only a few in the genus with such reduced blade architecture, and hence should be confused with no other species in Guatemala. In dissection of blade it superficially resembles *Cnemidaria*, but can be easily distinguished from the latter by the lack of indusia and by the veins, which neither anastomose nor connive at the sinus.



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